AD-A090 605 TEXAS UNIV AT ARLINGTON DEPT OF BIOLOGY F/G 8/8
ENVIRONMENTAL IMPACT STUDY OF THE ELM FORK REGION OF THE TRINIT--ETC(U)
APR 72 T R HAYS, T R HELLIER, T E KENNERLY DACW63-72-C-0001

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ENVIRONMENTAL IMPACT STUDY OF THE ELM FORK REGION OF THE TRINITY RIVER

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A090 605	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) (6) Environmental Impact Study of the Elm Fork Region of the Trinity River,		5. TYPE OF REPORT & PERIOD COVERED (9) Final rept.,
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) (10) Thomas R. Hays Thomas R. Hellier, Jr. Thomas E. Kennerly, Jr		8. CONTRACT OR GRANT NUMBER(s) (15) DACW63-72-C-0001 NEW
9. PERFORMING ORGANIZATION NAME AND ADDRESS The University of Texas at Arlington Department of Biology Arlington, Texas 76019		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS (12) 127
11. CONTROLLING OFFICE NAME AND ADDRESS Fort Worth District, Corps of Engineers Engineering Division, Planning Br., Environmental Resources Section, SWFED-PR, P.O. Box 17300, Fort Worth, Texas 76102		12. REPORT DATE (11) 14 Apr 1972
		13. NUMBER OF PAGES 108
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) NA		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release ; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Environmental aspects
Elm Fork Flood Control Project
Dallas County, Texas
Denton County, Texas

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A flood-control plan encompassing levee construction and channelization along the Elm Fork of the Trinity River from Lewisville Dam to the confluence with the West Fork would result in the destruction of archeological sites, paleontological sites, deterioration of water quality, and encouragement of increased human activity resulting in overgrazing, etc. The best alternative to the plan would be to place the floodplain area in public trust as part of the environmental corridor system as proposed in the North Central Texas Council of Governments (Regional Open Space Plan, 1972).

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

ENVIRONMENTAL IMPACT STUDY OF THE ELM FORK

REGION OF THE TRINITY RIVER

In conformance with Contract No. DACW63-72-C-0001 awarded to the Department of Biology, The University of Texas at Arlington, Arlington, Texas, this report is submitted to

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TABLE OF CONTENTS

GENERAL INTRODUCTION

This report is an environmental impact study addressed to effects of a proposed flood-control plan encompassing levee construction and channelization along the Elm Fork of the Trinity River from Lewisville Dam to confluence with the West Fork. Invesitgation of the Elm Fork, its flood plain and terraces was accomplished under Contract No. DACW63-72-C-0001 from the United States Army Corps of Engineers to the Biology Department of The University of Texas at Arlington and is in accordance with stipulations of the National Environmental Policy Act of 1969 (Public Law 91-190). This research is tripartite including sections on (1) an Archaeological survey, (2) an Aquatic Ecologic survey and (3) a Terrestrial Ecologic survey. Each survey is substantially replete. However, the most relevant findings from all surveys are coalesced in a final section. The thrust of this work is keynoted by the following statement from Public Law 91-190 (Title I, Section 101,(b),(1))"....fulfill the responsibilities of each generation as trustee of the environment for succeeding generations".

GENERAL ACKNOWLEDGMENTS

Each section of this report specifies the contribution of individuals but it is appropriate to emphasize the cooperation and encouragement of Mr. L. E. Horsman, Chief of the Environmental Resources Section, U. S. Army Corps of Engineers and his staff to the entire research team responsible for this project. Evelyn Buhl

contributed her talents by furnishing special, scaled maps of the study area.

PREFATORY REMARKS

In order to achieve a definitive assessment of the Elm Fork region in the realms of Archaeologic-Historic, Aquatic Ecology and Terrestrial Ecology, three teams of specialists (6 to 12 persons each) working uninterruptedly for two to four years would be required. Especially in the latter two realms it is essential to compare annual data for several years in order to establish reliable base-lines concerning species-diversity patterns, food-web relationships, population oscillations, productivities and energy efficiency ratios. The present study permitted an eight month research period so that it should be made clear that, with the exception of certain precise archaeologic-historical sites, the ecologic findings and recommendations are of a most generalized nature. It should also be understood that this report necessarily deals with flood control of the Elm Fork in its present state and our findings and recommendations would not be appropriate for future extrapolation if the nature of the Elm Fork region is altered significantly.

SECTION I

ARCHAEOLOGICAL, HISTORICAL, DEMOGRAPHIC AND PALEONTOLOGICAL SURVEY OF ELM FORK REGION

AN ARCHAEOLOGICAL SURVEY OF THE ELM FORK OF THE TRINITY RIVER

Introduction

During the late summer and fall of 1971, an archaeological survey was conducted within Dallas County along the Elm Fork of the Trinity River.[1] The surveyed area extends from near Bachman Lake at the north end of the Love Field runways northward past the Dallas-Denton County line. The east-west extent included the flood plain of the river and its tributaries and the slopes and alluvial terraces adjacent to the flood plain. The purpose of the survey was to identify, locate, and evaluate the archaeological resources of the area and the effect that planned levee construction and channelization would have upon these. Recommendations and cost estimates for the excavation of endangered resources are presented.

Acknowledgments

We wish to extend our gratitude to the following members of the Dallas Archeology Society for their aid. First to Mr. R. K. Harris for the use of his site notes and maps of known site locations of the area and for his taking time to show us the major sites. Paul Lorrain also pointed out the location of several sites. Other members including Paul Steed, Dr. Ruth Ann Ericson, Harvey Morgan, Hubie Achor, Frances Ballard and Jim Kingsley helped with the field work. Members of the Salvage Archaeology staff at S.M.U. including

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[1]This work was made possible through a grant (#30-179) from the Corps of Engineers to the Biology Department of The University of Texas at Arlington.

Alan Skinner and Olin McCormich, were helpful in all phases of the work.

The Physiographic and Environmental Setting

The Elm Fork of the Trinity River drains a part of the Central Texas section of the Great Plains Province. The boundaries of the Great Plains Province are subtle with residual plateaus on the southwest and low plains to the northeast. Most of this dissected and partly eroded region is composed of Early Cretaceous Edwards limestone which drops to the Coastal Plain on the southeast. Subdivisions of the province are based on the degree of erosion. The Central Texas region, exhibiting strong relief, is in the mature stage of erosion.

A variant region north of latitude 31° is a narrow strip called the Grand Prairie. This is bordered on the east and west by the Eastern and Western Cross Timbers, respectively. These narrow strips of forest are the only trees, except for some bushes, in otherwise open country. The Eastern Cross Timbers is pertinent to the Elm Fork area. Trees here occur in forest less than ten miles wide and follow a sandy stratum at the base of the Upper Cretaceous. They range as far south as Waco and separate the Grand Prairie from the Blackland Prairie to the East (Fenneman 1928; 1931). That part of the Elm Fork included in the survey follows somewhat the transition between the Eastern Cross Timbers and the Blackland Prairie.

The Elm Fork area is included in the northwestern part of the Texas Biotic Province, the western boundary of which is the Western Cross Timbers. Rainfall varies from no excess to 20% in excess of

need. The vegetation in these sandy soils includes oak-hickory forests and grass lands. Much of the area was originally tall grass prairie, but has changed in character due to cultivation.

The vegetation of the Blackland Prairie Area is described as medium tall, dense grass. The dominants being little bluestem (*Andropogon scoparius*) and Texas needlegrass (*Stipa leucotricha*). The Cross Timbers vegetation is that of medium tall grasses with broad leaf deciduous trees scattered singly or in extensive groves. The dominant vegetation is the little bluestem grass (*Andropogon scoparius*), Black Jack oak (*Quercus marilandica*), postoak (*Quercus stellata*); and various other vegetation species (Küchler, 1962). The fauna includes 49 species of mammals, 39 species of snakes, 5 species of Urodeles, and 15 species of Anurans (Blair, 1950).

The Alluvial Sequence and Geomorphology of the Lower Elm Fork of the Trinity River

The Elm Fork of the Trinity River flows in a country of gently rolling hills with a marked erosional history. The stream is surrounded by a flood-plain, about 1.5 miles in width, which rests on older riverine terraces. The Elm Fork follows the strike of the easily eroded shale of the Cretaceous Eagle Ford formation. This shale unit outcrops on the western bank rising to heights from 45 to 67 feet along a distance of 16 miles. The shale outcrop is dissected by a number of small resquent tributaries and forms a basis for the North Lake in its northern part. East of the Elm Fork, the river terraces bank against the Chalk outcrop of the Lower Austin

Member, which stands about 75 feet above the floodplain, at a distance of four miles from the stream.

The river terraces were first described as a part of the Trinity River system in Dallas County by Shuler (1935) and later by Pattillo (1940). The geology of the Trinity River Terraces was recently examined by Crook and Harris (1957) and Slaughter et al. (1962), who recognized the following terraces:

	Elevation above modern floodplain
T-5 Buckner Home-Hackberry Creek	145 ft.
T-4 Love Field-Bethal	100 ft.
T-3 Travis School-Farmers Branch	70 ft.
T-2 Pemberton Hill-Lewisville	50 ft.
T-1 Union Terminal-Carrollton	30 ft.
T-0 Floodplain (approx.)	

The Lovefield-Bethal Terrace, the highest terrace in the Elm Fork area is west of the Elm Fork near the town of Bethel, followed within an area of four miles by the Travis School-Farmers Branch Terrace, the Pemberton Hill-Lewisville Terrace, and the Union Terminal-Carrollton Terrace close to the stream. Only the latter two terraces are of archaeological importance. The Pemberton-Lewisville Terrace stands 50 feet above modern floodplain, consisting of the following lithological units; from base to top: (1) basal gravel, 10 feet; (2) laminated yellow sand, 5 feet; (3) Yellow sandy clay, 15 feet; and (4) dark grey alluvium, 5 feet. The famous Lewisville site was located in the yellow sandy clay unit, known as the Upper

Shuler Formation. Two radiocarbon dates on carbonaceous material from the site yielded an age estimate > 37,000 B.P. Slaughter et al. (1962,9) assign the Lewisville Terrace to the Last Interglacial or to a major interstadial in the Last Glacial, on the basis of the radiocarbon dates, faunal evidence, and correlation with the Red, Sulpher, Sabine, Brazos, and Leon River Valley sequences.

The Union Terminal-Carrollton Terrace is 30 feet above the present floodplain and consists of a basal gravel unit (5 ft.), a red sandy clay (5 ft.) and a top layer of grey unstratified sand (5 ft.). This terrace contains archaeological remains which are distinctively "Archaic". A radiocarbon date of 6,000 B.P. was obtained from this terrace (Slaughter et al., 1962,9). It is to be noted that the Archaic Stage is dated elsewhere between c. 10,000 and 4,000 B.P.

The floodplain consists of sand, gravel, and silt which lie about 20 feet above the river grade broken by a number of levees, 3 to 5 feet high. Remains of Late Pottery and Farming Neo-American communities are found in the floodplain. The remains also include scant evidence of Spanish explorations, and a surficial capping of Anglo-American materials (Slaughter et al., 1962,9).

Summary of Current Archaeological Literature and the History of the Area

Archaeologically the area surveyed falls within the North-Central area of Texas. Within this area four temporal stages are defined. Their designation and approximate temporal extent are as follows (Suhm, Krieger, and Jelks, 1954):

Name	Temporal Extent
Paleo-American	? - 7,000 B.P.
Archaic	6,000 B.P. - A.D. 500
Neo-American	A.D. 500 - A.D. 1541
Historic	A.D. 1541 - Present

It must be recognized that the breaks between these stages are not abrupt as indicated by the specific dates, but these periods represent times during which certain modes of subsistence were predominant. Generally speaking the first three of these stages relied on big game hunting, hunting and gathering both small game and plant foods, and agriculture respectively. The last stage includes that period after European contact was made and metal and glass technology was introduced. Likewise the transitions between stages did not occur synchronously over the whole of Texas and, thus, the data given above apply to the North-Central Texas area in general.

The Paleo-American Stage

This stage is usually recognized in this area by the presence of Clovis, Plainview, or Scottsbluff points. The Lewisville site, located at the confluence of Hickory Creek with the Elm Fork in Denton County, is the best-known and most controversial site of this stage in the area. This site, reported by Crook and Harris (1957, 1958, 1962), yielded a Clovis point from Hearth 1. Radiocarbon analysis gave three dates, two of > 37,000 B.P. (Crook and Harris: 1957, 1958) and one of > 38,000 B.P. (Crook and Harris: 1962). Without going into the details of the interpretations,

the dates are much too old for other dates of Clovis. The dates, however, may reflect accurately the date of the Pemberton Hill-Lewisville Alluvial Terrace (T-1) in which the site was located.

Other finds in the Dallas County area discussed by Crook and Harris (1957:70-79) included the Lagow Sand Pit Man, an artifact from the Pemberton Hill locality in situ in Upper Shuler material; three quartzite flakes from Denton County in the Upper Shuler formation; and a Clovis point from fill dirt delivered to an Oak Cliff resident. A possibly reworked Clovis point was also reported from the Obshner site in southeast Dallas County (Crook and Harris, 1955).

Other Paleo-American-like projectile point types have been found associated with the Archaic Carrollton focus sites. These include a Scottsbluff point reported from the Obshner site in southeast Dallas County (Crook and Harris, 1955), and a possible Scottsbluff point from the Irish Farm site now covered by the Garza-Little Elm Reservoir, in Denton County (Barber, 1966). Plainview points occur at a frequency of about 5% in Carrollton Focus sites (Crook and Harris, 1954a).

In conclusion, the evidence for Paleo-American occupation is rather sparse for the area and all of the finds mentioned above represent somewhat isolated occurrences. The Lewisville site dates are much older than the well dated Clovis sites of the Southwest, and the Plainview and Scottsbluff points are mixed with Carrollton Focus material, which dates later than would be expected for either Plainview or Scottsbluff (see discussion of the temporal placement of the Carrollton Focus below).

The Archaic Stage

The Trinity Aspect of the Archaic Stage was defined by Crook and Harris in 1952, with addition refinements in 1954. This aspect, composed of the Carrollton and Elam foci, centers in the Dallas County area, includes northeast Texas, and possibly extends into Louisiana and Oklahoma (Crook and Harris, 1952). The traits of the Carrollton and Elam foci were listed and discussed by Crook and Harris (1954a) and were included in the handbook of Texas Archaeology of Suhm, Krieger, and Jelks (1954).

The two type localities for the Carrollton focus are the Lake Dallas site, now covered by the Garza-Little Elm Reservoir (Harris 1939, 1951, and Stephenson, 1949), and the Wheeler site (Crook, 1952; Crook and Harris, 1953) located in the northeastern part of the surveyed area. The Wheeler site essentially has been destroyed by gravel operations.

Both of the above sites occurred in situ at the base of the Pattillo formation of the Union Terminal-Carrollton Terrace (T-1). Other sites of the Carrollton Focus occur in similar geological positions (Crook and Harris, 1954b, 1955, 1959; Lorrain, D., 1963; Barber, 1966). Crook and Harris (1952), considering the known Carrollton focus sites of that time, placed all sites within the Union Terminal-Carrollton Terrace (T-1) and, more specifically, confined to the upper part of the Albritton formation, on the contact between the Albritton and Pattillo formations, and into the lower six inches of the Pattillo formation. Correspondingly a

tentative temporal placement of 4,000 to 3,000 B.P. was made for the Carrollton Focus material (Crook and Harris, 1952).

The type localities for the Elam Focus are both found in southeast Dallas County. The Wood site, located in the Union Terminal-Carrollton Terrace at the confluence of Elam Creek with the Trinity, and the Milton site, located a mile to the southeast, have both yielded complexes which Crook and Harris (1952) considered to be identical. These are geologically later than Carrollton Focus material and seem typologically to be direct outgrowths of the Carrollton Focus material, yet distinct enough to be designated as the Elam Focus. The geological position of the Elam Focus material is restricted to the middle and upper parts of the Pattillo formation but not the surface of this T-1 terrace. The temporal position is estimated to fall between 2,500 and 1,500 B.P. ($\sim$ 500 A.D.) Crook and Harris, 1952). Suhm, Krieger and Jelks (1954, p. 80) felt that the two foci must overlap in time and not be separated by a 500 year gap.

The apparent difference in geographical distribution of the Carrollton and Elam Focus sites is reflected in a map prepared by Crook and Harris (1952, p. 8). Of six Carrollton Focus sites, four are along the lower Elm Fork drainage and of thirteen Elam Focus sites shown, all occur between the confluence of the Elm Fork and the East Fork with the Trinity River.

In conclusion, sites of the Carrollton Focus and possibly the Elam Focus should occur within the surveyed area. Both kinds of

sites would be expected to occur undisturbed buried within the Union Terminal-Carrollton terrace (T-1). There should be no pottery associated with these sites and the Elam Focus material should occur stratigraphically above the Carrollton Focus material.

The Neo-American Stage

This stage includes sites bearing pottery but showing no associated artifacts of European origin. Two foci have been defined in the area of Dallas County, the Henrietta Focus (Krieger, 1946) and the Wylie Focus (Stephenson, 1952). Only the Henrietta Focus is pertinent to the surveyed area, for the Wylie Focus sites are found along the East Fork of the Trinity River (Crook and Harris, 1952).

The Henrietta Focus was tentatively defined by Krieger in 1946 on the basis of excavations at the M. D. Harrell Site, located in Young County at the confluence of the Clear Fork and the Brazos River some 100 miles due west of the survey area. Suhm, Krieger, and Jelks (1954, p. 80) saw the Henrietta Focus as representing people leading a sedentary to semi-sedentary life supported by agriculture, hunting, gathering and fishing. Campsites are located on stream terraces and upland areas suitable for agriculture. These sites can be recognized by the presence of shell-tempered Nocona Plain pottery (Suhm, Krieger, and Jelks, 1954, p. 82). Other associated artifact traits are discussed by Krieger (1946) and Suhm, Krieger, and Jelks (1954).

Krieger, on the basis of Puebloan pottery occurring in the sites, placed the beginning of the Henrietta Focus at A.D. 1450 and estimated

the end around A.D. 1600. Suhm, Krieger, and Jelks give a temporal range of from A.D. 1400 to A.D. 1600. Harris reports a date of A.D. 1854 ± 145 years from a small site, located on the surface of the T-1 terrace, overlying the western extent of the Wheeler Site (R. K. Harris, personal communication). The site from which this date was obtained subsequently has been totally destroyed by sand mining.

Other Henrietta Focus sites have been reported along the Elm Fork drainage in Denton County (Harris, 1940, 1950, 1951). Hughes and Harris (1951) and Kirkland, Harris, and Hatzenbuehler (1949) have reported Henrietta Focus sites within the survey area. Lorrain (1963) reported surface finds of points and pottery along the eastern side of the Elm Fork just south of the Denton-Dallas County Line. These surface finds are on the T-1 terrace and, thus, are in an expected position for such a site. The artifacts are widely scattered with no heavy concentrations, but possibly represent Henrietta Focus occupations.

In conclusion, pottery bearing sites are known to occur in the survey area on the surface of the T-1 terrace. These sites most likely will be associated with the Henrietta Focus falling within a time range from early fifteenth century to the end of the seventeenth century A.D.

The Historic Stage

The earliest known contact with Europeans in north-central Texas would have occurred in 1541, when both Coronado and DeSoto made their

expeditions. It is likely, however, that the cultural remains traded or left behind would be few and scattered and not likely represented in archaeological collections.

It was not until 1690 that the Spanish began settling in eastern Texas and at about the same time that the French began establishing themselves in present day Mississippi at Biloxi. Trade relationships were established with the Indians by both the French and Spanish by the 1720's. It is at this time that European trade goods may be expected to start appearing in north-central Texas (Duffield and Jelks, 1961: 67-68).

During the 18th century the French and Spanish were in competition for the control of Texas. The site of a Spanish Fort on the Red River in Montague County, Texas is believed to be the large Taovayas village having a prominent envolvement in this struggle (Krieger, 1946: 161-164; Duffield and Jelks, 1961). An excellent discussion of the various contacts with Wichita Indians is given in Newcomb and Field (see Bell, Jelks, and Newcomb, 1967: 240-309).

Several sites in north-central Texas, including the Spanish Fort site, were used by Duffield and Jelks (1961: 69-75) as a basis for the preliminary definitions of the Norteño Focus. These sites are the Pearson, Spanish Fort, Sanders, Garrett's Bluff, Womack, Stansbury, Stone, and Vincent. Since that time the Womack Site (Harris _et al._, 1965), the Stansbury (Jelks, 1970; and Stephenson, 1970), and the Gilbert sites (Jelks, 1966) have been discussed and described in more detail. A study of Wichita archaeology and ethnohistory was completed in 1967 (Bell _et al._, 1967).

The only possible finds in the surveyed area which would indicate occupation during this early part of the historic period were two gun flints found at X41DL-16. This site has since been completely destroyed by gravel operations (R. K. Harris, Personal communication).

The Dallas County area was not intensively settled by the Europeans until the 1840's. One of the earliest settlements was Bird's Fort, established in the fall and winter of 1840-41 by Captain John Bird. In the fall of 1841, several families reached the fort including that of John Beeman (Brown, 1887: 10-11). James J. Beeman later brought the first wagon into Dallas, which had been founded by John Neely Bryan in 1841. The Parkinson diary (1843) mentions settlers encountered in the White Rock area. Dallas at that time was composed of thirty families spread out over about 30 square miles.

The Peter's Colony Grant, which included the Elm Fork area, was subdivided in March of 1846, creating Dallas County and other north Texas subdivsions. Peter's Colony had been created by the government of Texas in 1841, to encourage the settlement of northern Texas. Since Dallas was in the center of the new county and on the eastern side of the Trinity, it was made the county seat. Later in 1856, Dallas became an incorporated city and the settlement of the surrounding area was well under way.

Two sites, X41DL-8 and X41DL-9, contained artifactual material of the late historic period. The distinctive artifacts of this period, found on the surface of these sites, included square nails, and bottle necks showing the use of a lipping tool (Lorrain, 1970; and Newman, 1970).

Summary

The archaeological remains within the survey area should cover a time span from some 11,000 to 12,000 years ago to the present. The interpretation of this material has been placed within the framework of a temporal sequence of artifactual complexes. The interpretation, however, has been constructed from material collected as it eroded from the sites or as it was exposed in the sites by sand and gravel operations. No adequate excavation has been accomplished to date and studies of how this area has been exploited by man through the years have been neglected mainly because this was not the emphasis of archaeological studies until rather recently. Since such studies, especially if comparisons through time and between geographical area are to be made, depend on good temporal placement of exploitative activities, the foundation exists from which such ecological studies may be made. It is hoped that future excavations may be so directed.

One factor that is both a hindrance and help to the archaeologist is very pronounced in the survey area. While best preservation of the internal structure of a site occurs when the site becomes buried shortly after occupation, the problem of locating and excavating these sites becomes acute, especially when they are deeply buried. Sites in the surveyed area are buried, some rather deeply (e.g., X41DL-1 is between 5 and 6 meters below the present flood plain surface).

Since many sites in the area have been found through the commercial removal of sand and gravel, there was no time for adequate excavation and very often the site's internal structure has been

destroyed. Thus, it is necessary that sites be discovered in undisturbed areas. Undisturbed areas, in prime locations preferred by the prehistoric inhabitants for their campsites, do exist in the Elm Fork drainage.

RESULTS OF THE ARCHAEOLOGICAL SURVEY

The 35 sites shown for the survey area (Fig. 1) included newly located sites, others recorded by R. K. Harris and the Dallas Archaeology Society in 1939, and sites which were reported by local amateurs and collectors. Not all of the sites recorded in 1939, were relocated and others have since been destroyed by gravel operations. It is important, however, to record all known sites and their present status for a total evaluation of the archaeological resources of this area. Exact site locations are not included in this report, but are available from records on file at The University of Texas at Arlington, Department of Sociology or at Southern Methodist University, Department of Anthropology.

Archaeological sites of the area fall into three rather distinctive groups, each consistently occurring in similar geographical positions: in the flood plain, in or on one of the alluvial terraces, and on the uplands.

1) The flood plain sites, (X41DL-1, X41DL-3, X41DL-35), usually buried from one to four meters, consist of concentrations of burned rock, discarded mussel shells, some flint tools and waste flakes. These sites seem to represent a single event of preparing and eating fresh water mussels. Projectile points are present and indicate this

activity may have resulted from a small hunting party stopping for a meal or for overnight.

2) The terrace sites are most often exposed by the removal of sand and gravel from terrace deposits, (X41DL-2, X41DL-12, X41DL-10, and X41DL-32). The cultural material is usually dispersed both vertically and horizontally within a sand deposit. This dispersal may have been created by reoccupation of the same general area as the alluvial deposits were building up. Although all that usually is preserved is lithic material, burials have been removed from X41DL-13.

Other sites appear on the surface of these terraces (X41DL-8 and X41DL-7). The approximately two meter deep cultural zone at X41DL-8 indicates intensive occupation over a long period of time as the alluvial deposit built up. This resulted in sufficient concentration of organic matter within the alluvium to produce a dark stained midden deposit in which relatively good preservation of shell and bone has occurred. This site is unique in this respect. These sites are expected to fall within the time range of 4,000 B.C. to A.D. 500 with X41DL-8 occurring rather late.

3) The upland sites are indicated by a single designation X41DL-33 and occur scattered over the hills immediately west of the area surveyed. These sites are found where natural cobble deposits occur on the surface and represent the quarrying of raw material including quartzite and chert. These sites may be of any age for these resources were continually used.

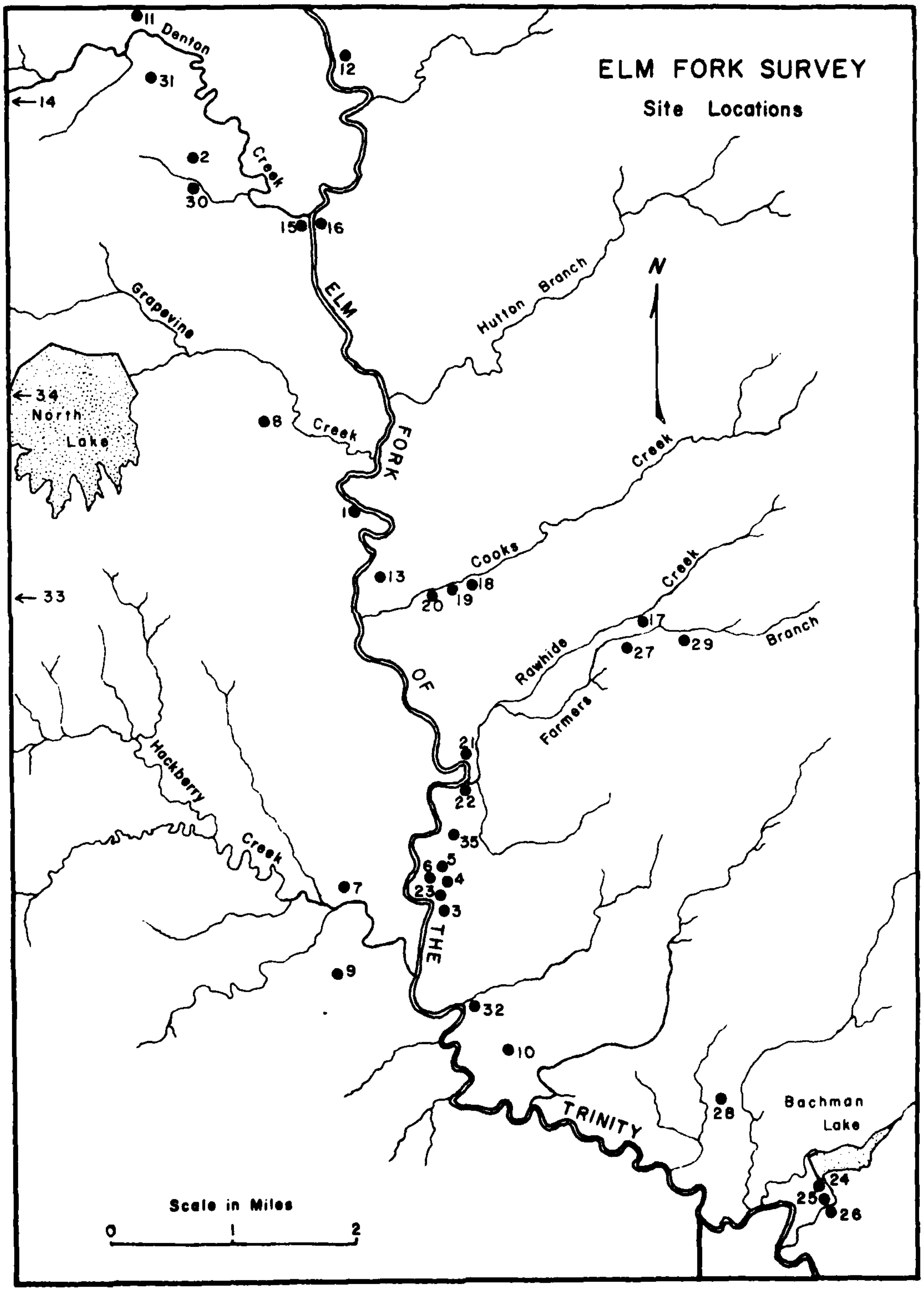

Fig. 1: The distribution of recorded sites within the lower Elm Fork drainage. Note: sites 14, 33, and 34 are immediately west of the corresponding number. Some of the endangered sites locations are shown on Plates 1, 2, and 3.

Conclusions

Both field observation and the archaeological literature for the surveyed area indicate that relatively few sites appear on the surface and those that do are relatively late, of the Neo-American and Historic stages. Even these sites may occur buried, for historic artifacts (spoons, etc.) have been observed in the area some 2-1/2 to 3 meters under the present flood plain surface (Bob Slaughter, personal communication). Also a burial removed by the Dallas Museum of Natural History during the construction of the Elm Fork Golf Course in 1967, was some 4 meters below the surface. A date for the burial of A.D. 1309 $\pm$ 150 was obtained from associated charcoal (R. K. Harris, personal communication). These sites indicate a rather fast rate of alluviation in the recent past. Such alluviation has also preserved older sites in the terraces. This fact enhances the possibilities of finding sites in geologically stratified relationships, sites which represent single activities such as food preparation, camping, and butchering, sites which represent short term occupation of an area on a seasonal basis, and long term base camp sites from which various environmental resources were utilized. Without going into more detail, it is the stratified buried sites which provide the archaeologist with temporal control necessary for making spatial as well as temporal comparisons of prehistoric cultural systems, and also enable him to identify specific activities necessary to reconstruct these systems. The archaeological potential of the area is unrealized at this time for

only the temporal variable is somewhat controlled, which has been accomplished by a devoted group of amateur archaeologists who have laid a foundation necessary for future work. Thus, an understanding of the prehistoric and historic occupation of the surveyed area is presently limited to knowing characteristic artifact complexes and how these are related through time and space. This has been accomplished although no adequate excavation has been completed within the surveyed area. It will be only through continued work, including rather extensive excavations, that a more comprehensive understanding of how the American Indian utilized the area's various environmental resources can be realized.

There are sites within the area which will serve this purpose, but most of these have been partially destroyed by erosional factors if not by modern commercial exploitation of the area. Some sites are still in such condition that data can be obtained from them. Others need to be located and this can only be achieved through systematic testing of areas where sites would be expected based on the location of known sites. Such tests are necessary because: (1) most sites in the area are buried; (2) it is buried sites that can furnish the data needed for activity studies; (3) once a site has been uncovered by commercial activities these usually cannot be halted while the archaeologist salvages the remaining information.

Recommendations for Excavations

Site X41DL-8 is situated adjacent to the western flood plain of the Elm Fork at its confluence with Grapevine Creek. This site,

badly disturbed by the construction of trench silos, is located in an isolated remnant of alluvial deposit probably associated with the deposition of the T-1 terrace. This remnant, essentially removed by erosion, contains prehistoric occupation debris extending from the surface (which also yields historic material) to an observable depth of 2-1/2 meters. In places this occupation level extends down to a gravel stratum.

The occupation layer, consisting of an ashy, sandy, somewhat cemented dark stained matrix, contains much debris and trash. The lithic tools include flakes and chips indicative of tool preparation and replacement. The stone tools observed consist of bifacially worked pieces and projectile points. No complete points were recovered but the pieces indicate that the points used were rather large and probably of the types associated with the hunting and gathering subsistence of the Archaic Stage. A definite temporal placement of this site, however, cannot be made at this time.

Food remains from the site indicate utilization of a variety of micro-environments. Mussel shells are common and would be obtained from the river or from the sluggish meanders of Grapevine Creek on the flood plain. Animals, of both large and small species, indicate hunting within the flood plain and the uplands. Birds and turtles are also represented. Bone preservation within this site is unusually good for the area and bones are plentiful enough for an excellent analysis of animal food resources.

Several fragments of human bone were recovered from the sides

of the trench silos showing indications of cremation. Although this form of burial limits somewhat the usefulness of the skeletal material to the Physical Anthropologist, it has rather unique implications for the social and possibly the religious practices of the people.

In conclusion, this site is seemingly a base camp occupied continuously for a rather long time and offers a varied range of possible data that would enable the archaeologist to gain better temporal control for the Elm Fork area, interpret the aboriginal exploitation of this environment, and determine how this exploitation and possibly the technology of the people changed through time. If the animal remains are of a certain nature it may be possible to ascertain if the site was occupied during a given seasonal activity or year round. This site should definitely be excavated.

There are two other localities in the area that are geographically and geologically situated in a similar manner. These sites, however, had no cuts into their surfaces and thus it was impossible to observe the depth and nature of the occupation zone. These sites, X41DL-7 and X41DL-9, should be tested and, depending on the results, should possibly be excavated. Both sites are located adjacent to the western flood plain of the Elm Fork and at the confluence of Hackberry Creek with the river.

All three of the aforementioned sites, located where levees will abutt to the western uplands, lie at the foot of hills which today are covered mainly with Mesquite and grass. Physiographically, the

hills probably fell within the transition between the Eastern Cross Timbers and the Black Land Prairie Regions during the pre-historic times. This would situate these sites in a position for the exploitation of the unique micro-environment of the river bank, the flood plain, the above mentioned transitional zone, and the Eastern Cross Timbers further to the northwest. All of these sites would be damaged by proposed levee construction.

Even though the Wheeler Site is a type location for the definition of the Carrollton Focus, no part of it has been thoroughly excavated. The artifacts were either collected from the slump material occurring along the edges of the site or removed from *in situ* when the pit walls were exposed by either slumping or sand removal. A controlled excavation at this site would possibly confirm the earlier defined focus. Thus, testing for an occupation zone in the area to be modified by levee construction should be carried out. An excavation should follow if the testing yields positive results and the data recovered is unique and applicable to the definition of the Carrollton Focus or if a better understanding of the exploitation of the area by the people of Carrollton Focus times can be gained.

There are also areas along the eastern edge of the flood plain where levees will abutt to the T-1 terrace. Because of the function of levees, these abutments occur where sites are likely to exist, for a preferred location for occupation was on high ground adjacent to the flood plain at the confluence of a tributary with the Elm

Fork. These areas could not be evaluated thoroughly because of dense vegetational growth on the surface. It is also likely that sites, if present, are buried.

It is recommended that six of these areas be tested. These include: (1) the area south of where Hutton Branch cuts the T-1 terrace, (2) areas both north and (3) south of where Cooks Branch cuts the T-1 terrace, (4) the area north of Rawhide Branch, (5) between Rawhide Branch and Farmers Branch, and (6) south of Farmers Branch where these two tributaries cut the T-1 terrace. If any of these tests yield positive results, those which seem to be yielding data pertinent to the archaeological interpretation of the aboriginal inhabitation through time and the exploitation of the area should be expanded into a controlled excavation.

There is one other area that should likewise be tested and evaluated before an actual excavation is effected. This area, adjacent to both sides of Wildwood Drive west of the St. Louis and San Francisco R.R., and lying immediately south of Lombardy Lane (California Crossing), is a very likely area to contain a buried site. In the same terrace to the northwest a concentrated "Archaic" occupation had been exposed and subsequently destroyed by gravel operations (Site X41DL-31).

Also along both sides of Wildwood Drive, just north of the drop off to the flood plain, flakes, projectile points and burned rock fragments are eroding from the road-cut (Site X41DL-10). The aerial photos provided by the Corps of Engineers show the presence

of an old river channel adjacent to the terrace. This area is also likely to be disturbed by the levee construction planned for the area. This occupation, if present in sufficient concentrations, should provide information necessary for a more complete understanding of the temporal changes of technology and exploitation of the area. This site, situated on a somewhat lower terrace than the T-1, should represent a later occupation than the above sites in the T-1 terrace and thus should provide transitional material between the T-1 terrace sites and the sites buried in the flood plain.

Sites also occur buried in the present day flood plain and are exposed by natural erosion (X41DL-1), but mainly by commercial sand and gravel operations (X41DL-3 through X41DL-6). These sites seem to represent the exploitation of riverine resources, for most of the cultural debris includes fire cracked and burned rock in association with mussel shells, and a few lithic tools including projectile points and flakes.

Excavation of three of these small sites would help clarify their temporal placement and determine the utilization of the environment that they represent. It is likely that they represent, among other possibilities, small groups of men on a hunting party stopping long enough to repair their weapons and enjoy a meal of freshly baked mussels.

<u>Summary</u>

The lower Elm Fork drainage is located within a transition between two major ecological zones, the Eastern Cross Timbers to the

west and the Blackland Prairie to the east. This creates a great diversity of exploitable micro-environments accessible from the Elm Fork, the permanent water source resource needed by prehistoric inhabitants. With the present emphasis in archaeology directed toward the interaction between prehistoric man and his environment, this area offers unique opportunities for such studies. This is further enhanced by the rather good temporal control that has been obtained for the various identified artifactual complexes of the area and by the fact that most of the sites in the area have been buried rather soon after their occupation. This rapid burial promotes the preservation of a site's internal structure and thus its usefulness in identifying exploitative activities. It also creates problems of site location and overburden removal. It is felt that the recommendations and estimates of cost presented here will facilitate such studies and at the same time make use of archaeological resources that are in danger of being destroyed by the planned levee construction within the area.

ESTIMATE OF COSTS OF ARCHAEOLOGICAL INVESTIGATIONS

It is felt that to conduct the suggested excavations and tests a three month field session would be necessary. During this time two crews, each consisting of five members under the direction of an assistant archaeologist, would be working. In conjunction with the above work an assistant geologist would analyze the position of these sites within the alluvial chronology of the area as well as study the

internal structure of the deposits in which the sites are located. This work would be directed and co-ordinated by an archaeologist. This field session would be followed by a nine month analysis and publication period during which the principal archaeologist would be assisted by one other person.

A budget of estimated costs follows:

1 Archaeologist	12 months @800/month	$ 9,600.00	
1 Asst. Archaeologist	3 months @$500/month	1,500.00	
1 Asst. Archaeologist	12 months @$500/month	6,000.00	
1 Asst. Geologist	3 months @$500/month	1,500.00	
10 Laborers	60-8 hr. days @$3/hour	14,400.00	
	SUB TOTAL OF SALARIES		$33,000.00
Services and Supplies			
Drafting	$500.00		
Photography	500.00		
Typing	300.00		
Expendable Supplies	400.00	$ 1,700.00	
Travel and Vehicle			
40 miles/trip x 4 cars	= 160 miles/trip		
60 days with 1 trip/day	= 60 trips		
160 miles/trip x 60 trips	= 9600 miles		
@10¢/mile		$ 960.00	
Publication		$ 1,000.00	
Equipment		$ 1,000.00	
C_{14} Samples		$ 1,000.00	
Per diem for Archaeologist @$10/day for 15 days		$ 150.00	
	SUB TOTAL		$ 5,810.00
	TOTAL		$38,810.00

SOCIO-DEMOGRAPHIC FACTORS AND ATTITUDES TOWARD RECHANNELIZATION OF THE TRINITY RIVER

Introduction

The purpose of this study was to identify the attitudes of the residents of Dallas County toward rechannelization of the Elm Fork of the Trinity River. The study was divided into two phases: (1) A descriptive analysis of a random sample of residents from Dallas County. This phase consisted primarily of a discussion of the social and demographic characteristics of the sample, as well as a discussion of their attitudes toward rechannelization. (2) The second phase of the study is more analytical. This phase involves the comparison of a sub-sample of persons who would be directly affected by the plans of the U. S. Corps of Engineers to rechannel the Trinity River with a sub-sample of residents of Dallas County who would not be directly affected. The characteristics considered in the analytical phase are those deemed most relevant for the successful implementation of the plans for rechannelization.

Methodology

The initial sample resulted from two objective procedures. The first step involved an enumeration of residents in the area to be directly affected by rechannelization plans followed by the selection of a random sample. In order to ascertain the feelings of the Greater Dallas area residents regarding plans to rechannel the Trinity River, a random sample was selected from the City Directory. The total sample

included approximately 600 persons. A uniform questionnaire[1], with a prepaid envelope enclosed, was mailed to each selected person. Because the return rate was not as high as initially anticipated, it was necessary to supplement the sample from the affected area by employing a professional interviewer. The procedure yielded a total of 79 respondents from areas of the city who will not be directly affected by rechannelization and 49 respondents from the areas designated for rechannelization. The residents of the latter area will be displaced if the preliminary plans are implemented.

In the analytical phase of this research the Chi-Square test of significance was utilized to analyze the relationships between people directly affected and those not affected and certain attitudes that they have pertaining to the rechannelization proposal. Percentages were also employed to indicate the direction of the relationship of each cross-classification.

There are certain limitations involved in the use of Chi-Square as a test of statistical significance. The Chi-Square is dependent upon the size of the sample: small differences between the observed and theoretical frequencies often lead to significant relationships, even though actual differences may be small. However, qualitative data such as those utilized in this study, are not amenable to other forms of statistical analysis.

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[1]A copy of the questionnaire is attached (appendix A).

Social and Demographic Characteristics

As mentioned previously the first phase of the analysis is primarily descriptive of the characteristics of the total sample, consisting of 123 respondents. 69.1 percent of the respondents were male while 30.9 percent of the respondents were female. An observation of the data concerning the racial composition of the sample indicated that 92.6 percent of the total sample were white, 3.3 percent were black, and 4.1 percent were chicano.

It was anticipated that a large proportion of the respondents would be heads of household, and the response to a question of marital status indicated that 77.2 percent of the respondents were married, 7.3 percent were single, 10.6 percent were widowed, while only 2.4 percent were divorced. The relative size of household was determined by questions pertaining to the number of children. It was found that 20.7 percent of the respondents had no children, 31.4 percent had children under the age of thirteen, and 38.8 percent of the respondents had children between the ages of thirteen and eighteen.

Regarding employment, only 73 percent of the heads of households were presently employed. In conjunction with questions concerning employment status, the usual classification utilized by the Bureau of Census to categorize occupations was utilized. It was discovered that 24.8 percent of the total sample were in professional or related occupations, 7.4 percent of the sample were managerial, 18.1 percent were in clerical and sales occupations, 9.9 percent were employed in service occupations, and 24 percent were skilled or manual labor. 2.4 percent were retired. Related to the employment status of the

head of household is the employment status of the wife. It was found that 43 percent of the wives of the household heads were employed. Among the employed spouses, 14 percent were employed in professional or managerial occupations, 14.8 percent were employed in clerical or sales occupations, 5.8 percent were employed in service occupations, and 11.6 percent were employed in skilled or manual labor. Closely associated with the employment status of the household heads and the employment status of the household head's spouse is the total family income. It was found that 10.5 percent of the families made less than $5,000 annually, 14.1 percent of the respondents earned between $5,000 - 7,999 a year, 10.7 percent of the respondents earned between $8,000 - 9,999 per year and 28.1 percent of the families made between $10,000 - 14,999 per year. It is interesting to note that 36.4 percent of the families earned $15,000 or more annually. This percentage can be explained partially by the higher income of household heads residing in areas not affected by planned rechannelization.

In an attempt to obtain a demographic profile of the social mobility of the respondents, selected questions were asked pertaining to the respondent's education and the education of the respondent's parents. It was found that in the total sample, 25.4 percent had less than 10 years of formal education, 28.7 percent had between 10 - 12 years of education, while 45.9 percent had some college or had graduated from college. Equally important is the amount of education of the head of household's spouse. It was discovered that 15.7 percent of the household head's spouses had less than 10 years of education, 36.4 percent had between 10 - 12 years of formal

schooling, 28.1 percent had at least some college or had graduated from college. One frequently used measure of upward mobility is to compare the respondent's education with the education level attained by the respondent's parents. In this study it was found that 44.8 percent of the mothers of the household heads had less than 10 years of formal education, 34.4 percent had between 10 - 12 years of education, and only 20.8 percent had some college or had graduated from college. When attention was focused on the educational level attained by the head of household's father, it was discovered that 42.9 percent had less than a tenth grade education, 41.8 percent had between 10 - 12 years of education, whereas only 15.3 percent had some college or graduated from college.

In a study of the social and demographic characteristics of individuals likely to be dislocated from their present dwelling, it is necessary to focus attention on such items as tenure and length of residence. An observation of the data indicated that 92 household heads or 75 percent of the sample own their own dwelling. Closely related to tenure status is the status they had prior to moving into the area. It was found that only 46.3 percent of the families owned their home prior to moving into their present dwelling. A further observation was that 38.2 percent of the respondents have lived in their present dwelling three years or less, 20.3 percent have lived in their present dwelling from 4 - 6 years, 14.6 percent have lived in their present dwelling from 7 - 10 years, whereas 23.6 percent have lived in their present dwelling over 10 years.

The discussion thus far has presented a socio-demographic profile of the sample residents of the Greater Dallas metropolitan area. The discussion which follows is more analytical in that the primary objective is to detect differences which may exist between the two sub-samples; that is, a sample of respondents directly affected by proposed rechannelization and a sample of respondents from other areas of the city.

The Relationship Between Locality of Residence[1] and Socio-Demographic Characteristics

In the previous section it was mentioned that statistical tests of significance would be conducted in order to determine if the residents of the area to be directly affected differ significantly on selected variables from the population in other areas of the city. In the conceptual stages of the research project it was hypothesized that the residents of the area directly affected would differ from a sample of the general population. The justification for making hypotheses concerning the socio-demographic composition of the population directly affected by the plans to rechannel the Trinity River were derived from "on the site" observation of the housing and other information provided about the area. The map furnished by the U. S. Corps of Engineers provided the delineation of the area to be affected. In the following table tests of the relationship between selected socio-demographic factors and locality of residence are presented. (Table I).

[1]See Appendix B (Tables 1 - 8).

TABLE I: The Relationship Between Locality of Residence and Socio-Demographic Factors Using the Chi-Square Distribution

	X_1	X_2	X_3	X_4
Locality	2.060^{ns}	4.379*	26.218***	3.313^{ns}
	X_5	X_6	X_7	X_8
Locality	3.276^{ns}	11.166**	6.513*	7.864*

ns = not significant   * = Pr .05   ** = Pr .01   *** = Pr .001

In the above table it is apparent that the residents of the area to be directly affected by rechannelization do not differ significantly from the other groups in their age composition. Most of the respondents in both sub-samples were over forty years of age. In the area directly affected, a slightly higher proportion were 60 years old or older (18.4 percent compared to only 12.2 percent in the area not directly affected).

When attention was focused on the employment status, significant differences were observed. In the directly affected area only 62.5 percent of the respondents indicated that they were gainfully employed, while over three-fourths or 79.7 percent of the sample from the other areas of the city were employed on a full-time basis. Closely related to employment status is the educational level of the respondents. It was on this variable that the greatest difference was observed. In the area directly affected, 49.0 percent of the respondents had less than a tenth-grade education, and only 9.6 percent of the other sample had less than 10 years of formal education. More striking, however,

is the fact that 60.3 percent of the sample from the unaffected area had some college compared to only 24.5 percent of the respondents from the affected area.

Because it was hypothesized initially that the respondents from the area directly affected would have a lower educational attainment level, it was decided to utilize a measure of social mobility to determine whether or not the respondents from the directly affected area were as upwardly mobile as the respondents from the unaffected areas of the city. A frequent determinant of upward mobility consists of the educational level of the respondent's parents compared to their own educational level. In comparing the educational level of the respondents from the affected areas with the educational level of the parents of the respondents from the unaffected areas of the city, it was discovered that there were no significant differences in the education of parents of both groups. It is quite interesting to note, however, that the educational level of the respondents from the affected area was almost the same as the educational level of their parents. Among the respondents from other areas of the city, the educational level was significantly higher than that of their parents. Thus, it becomes quite apparent that the respondents from the area not affected by rechannelization of the Trinity River are more upwardly mobile than the respondents from the affected areas.

When comparing the locality of residence and length of residence at the present dwelling, a significant relationship was observed. Almost 45 percent of the respondents from the affected area had lived there 3 years or less. More important, however, is the fact that

36.1 percent of this sample had lived in this area over 11 years. On the other hand, of the respondents from areas not affected by rechannelization, 36.2 percent had lived there 3 years or less, while only 16 percent had lived in their present dwelling 11 years or longer. It is apparent that the respondents from the affected areas have a high proportion who have lived there less than 3 years. On the other hand, over 2 times as many respondents from the directly affected area have lived in their homes 11 years or longer when compared to the respondents in the sample from non-affected areas. This may imply a greater reluctance on the part of the respondents from the directly affected area to move to other areas in the community.

The relationship between locality of residence and tenure yields some other very interesting findings. Among the residents in the directly affected area, 63.3 percent presently own their own homes. When the question concerning tenure status prior to moving into their present dwelling was tested, a significant relationship was observed. Only 30.9 percent of the directly affected respondents owned their homes prior to moving into the area now to be affected by proposed rechannelization of the Trinity River. However, it was noted that 58.9 percent of the respondents from areas not to be affected owned their homes prior to moving to their present dwelling. It is apparent from the data that the move resulted in a change of tenure status; that is, a large proportion of the respondents in the area to be affected by proposed rechannelization changed their status from that of renter to home buyer. Perhaps one of the major reasons for moving into the area that will be affected by rechannelization was the desire

and opportunity to own their own home. Since a high proportion of the residents that lived in the area to be affected did not own their own homes but own them now and also have lived there over 11 years, one could speculate that there may be some resistance from persons who own their own homes to relocate in other areas of the community.

The Relationship Between Locality of Residence and Attitudes Toward the Neighborhood

Since this study involved a possible relocation of several hundred families, it was necessary to ascertain the attitudes of the people to be relocated toward the neighborhood in which they live. For comparative purposes, the possible relocatees are paired with the respondents selected randomly from other areas of the Dallas Community. The results of testing the relationship between locality of residence and attitudes toward the neighborhood is presented in Table II.

TABLE II: Relationship Between Locality of Residence and Attitudes Toward Neighborhood Using the Chi-Square Distribution

	X_1	X_2	X_3
Locality	14.478***	17.836***	4.963*

ns = not significant   * = Pr .05   ** = Pr .01   *** = Pr .001

X_1 = Attitudes Toward Neighborhood
X_2 = Attitudes Toward Whether Neighborhood is Good
X_3 = Attitudes Toward Sentiments Toward Neighborhood

In the above table several relationships were tested. The initial relationship concerns the attitudes of the respondents toward the neighborhood in which they presently reside. The investigators asked the question, "Considering everything, would you say you are satisfied or dissatisfied with your neighborhood as a place to live?" It is obvious from the data in Table II[1] that there is a highly significant relationship between locality of residence and attitudes toward the neighborhood. A close inspection of that data contained in Table 9 in the appendix indicated that only 57 percent of the respondents directly affected by rechannelization of the Trinity River are satisfield with their neighborhood. In other areas, however, 87.4 percent of the respondents indicated a high degree of satisfaction with their neighborhood.

Closely related to the respondent's satisfaction with the neighborhood is his opinion of the neighborhood "as a good place to live." An analysis of the data indicates that the two sub-samples also differ significantly on this item. Only 53.2 percent of the respondents directly affected frequently feel that their neighborhood is a good place to live whereas 87.6 percent of the respondents from other areas of the city seem quite content with their neighborhood.

When the respondents from the two areas were asked questions concerning their sentiments toward their neighborhood, again a significant relationship was observed. It was found that only 17 percent of the

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[1]See Appendix B (Tables 9 - 11).

respondents from the directly affected area would "miss the neighborhood, again a significant relationship was observed. It was found that only 17 percent of the respondents from the directly affected area would "miss the neighborhood very much" if they had to leave, whereas 32 percent of the residents of the areas unaffected by rechannelization showed very strong sentiments toward their neighborhood.

The Relationship Between Locality of Residence and Attitudes Toward Community Agencies

In order to make an accurate assessment of the impact of any proposed new program, it is necessary to view the attitudes of the people to be affected by the program toward the agencies in the community that provide some of the basic services. At the same time, however, it is also necessary for analytical purposes to compare them with the respondents from areas that will not be affected by the proposed program, in this case rechannelization of the Trinity River. The following table demonstrated the relationship between locality of residence and attitudes toward service agencies that have the responsibility of providing the citizenry with specific services.

TABLE III: Relationship Between Locality of Residence and Attitudes Toward Community Organizational Activities to Improve Neighborhood Using the Chi-Square Distribution

	X_1	X_2	X_3
Locality	4.316^{ns}	4.521^{ns}	7.409*

ns = not significant   * = Pr .05   ** = Pr .01   *** = Pr .001

X_1 = Attitudes Toward Federal Organizations
X_2 = Attitudes Toward Conservation Societies
X_3 = Attitudes Toward State Improvement Organizations

In the above table it is evident that the respondents from both samples feel similarly about the involvement of federal agencies in activities to improve conditions in the community.[1] However, it is interesting to note that 56.8 percent of the respondents directly affected feel that federal agencies are not doing anything to improve conditions in their community. In the area not to be affected by rechannelization, 39.3 percent had negative attitudes toward the degree of involvement of Federal agencies.

When attention is focused on conservation societies a similar finding was observed. In this case 82.9 percent of the respondents in the affected area felt that conservation societies were doing nothing while 61.8 percent of the sub-sample from unaffected areas reflect the same attitude.

Finally, when asked to what extent State Improvement Organizations

[1]See Appendix B (Tables 12 - 14).

were working to better the conditions in the neighborhood, the data reflected a significant difference between the two groups. In the area directly affected by rechannelization, 47.9 percent said nothing was being done whereas only 32.2 percent of the respondents from unaffected areas felt this way. Thus, it is apparent that only the residents outside the area not affected feel that state improvement organizations are making significant contributions to the improvement of their respective neighborhoods.

Relationship Between Locality of Residence and Factors Related to Rechannelization of Trinity River

In the preceding discussions a number of relationships have been observed which reflect the socio-demographic composition of the population and attitudes toward organizations and their neighborhood. This section is of special importance since it analyzes the most salient factors to be considered in a program such as the proposed rechannelization of the Elm Fork of the Trinity River. The following table presents tests of the relationship between locality of residence and the most relevent factors associated with the proposal to rechannel the Trinity River.

TABLE IV: Relationship Between Locality of Residence and Rechannelization Using the Chi-Square Distribution

	X_1	X_2	X_3	X_4
Locality	10.016**	25.769***	5.461*	3.578^{ns}
	X_5	X_6	X_7	X_8
Locality	10.623**	1.451^{ns}	2.395^{ns}	1.182^{ns}

ns = not significant * = Pr .05 ** = Pr .01 *** = Pr .001

X_1 = Attitude Toward Water Supply
X_2 = Attitude Toward Flood Control
X_3 = Attitude Toward Parks and Recreation
X_4 = Attitude Toward Environmental Protection
X_5 = Attitude Toward Sewage Disposal
X_6 = Attitude That Rechannelization will Reduce Hazards of Flooding
X_7 = Attitude Toward Relocation
X_8 = Attitude Toward Changing the Natural Environment

Observation of the data contained in Table IV indicated that there are a number of significant relationships.[1] When attention was focused on the relationship between locality of residence and attitudes toward the relationship between locality of residence and attitudes toward the water supply, it was discovered that 77.6 percent of those people directly affected by the rechannelization indicated satisfaction with the water supply, and 93 percent of the respondents in unaffected areas indicated a high degree of satisfaction with the water supply.

[1]See Appendix B (Table 15 - 22).

An examination of the data concerning locality of residence and attitude toward flood control indicated that only a small proportion of the persons directly affected by proposed rechannelization are satisfied with the present attempts by local agencies to control the back-up waters. Only 35.6 percent of those directly affected are satisfied with this service as compared to 82.8 percent of the sample of respondents outside the area. It is logical to assume that the persons not directly affected are unaware of many of the problems that exist in the Trinity River Basin. It is also safe to assume that among the respondents who are directly affected there is more concern because of their location.

An observation of the data concerning the relationship between locality of residence and attitudes toward parks and recreation facilities indicates that the two groups differ significantly. Only 72.7 percent of the individuals affected by the plans to rechannel the Trinity River appear to be satisfied with parks and recreational facilities whereas 90.1 percent of the respondents in other areas of the community indicate a high degree of satisfaction with the parks and recreational facilities. It is interesting to note that there is not a significant relationship between locality of residence and attitudes toward environmental protection they receive by local agencies. One very interesting aspect about this particular item is the fact that the high proportion: that is, 13.8 percent of the respondents not affected by rechannelization indicate a high degree of dissatisfaction with environmental protection while only 9.1 percent of the individuals directly affected by rechannelization

indicate that they are dissatisfied.

Finally, an examination of the relationship between locality of residence and attitudes toward sewage disposal indicates a very high significant relationship. Only 62.2 percent of the directly affected respondents indicated satisfaction with sewage disposal in their community. On the other hand, 85.2 percent of the sample of respondents from other areas of the community indicated that they are satisfield with the sewage disposal in their respective areas. When attention was focused on the problem of reducing the hazards of flooding, there was almost unanimous agreement that rechanneling and levee building in the Trinity River basin would reduce the hazards of flooding. In both samples 94 percent felt that rechannelization and levee building was needed.

Perhaps the central issue in this study is the feeling of the respondents toward relocation since this may be inevitable should the U. S. Corps of Engineers obtain a directive to proceed with the plans to rechannel the river. It is estimated that approximately 200 families will be affected. In the analysis of the data it was discovered that there was not a significant difference between the two sample groups. In the area directly affected, almost one-half or 45.7 percent approved relocation if necessary while 39.1 percent of the respondents from the unaffected area approved. More importantly is the fact that only 11.8 percent of the respondents in the affected areas strongly disapproved of relocation.

Finally, a question was asked concerning any attempt to change the natural environment. Again, no significant differences were

observed. However, a slightly higher proportion, 51.6 percent from the unaffected area, indicated they would prefer to see the environment remain unchanged while 38.1 percent of the respondents from the directly affected area agreed. This is surprising since the implication is that the respondents from the directly affected area would be expected to offer more resistance. However, it could be that they are acutely aware of the need for action, even at the risk of relocation, which would result if the natural environment is changed.

SUMMARY AND CONCLUSIONS

In summarizing the social-demographic characteristics of the total sample, the following conclusions are justified: (1) A high proportion of the respondents were males; (2) most of the respondents were under 50 years of age; (3) almost all of the respondents were Caucasian; (4) a majority of the respondents were married; (5) most of the respondents had children ranging from 1-18 years of age, and in many cases several children were present in each household; (6) a majority of the household heads were employed with almost an equal number in the higher occupational categories as in lower occupational categories; (7) an equal number of the spouses were employed which means that approximately the same number of household heads spouses were employed as not; (8) there was a rather even distribution from the high-ranking occupations to the low-ranking occupations when the occupational ranking of the spouse was observed; (9) the income level of the total sample appears to be somewhat higher than would be anticipated. This, however, can be attributed to the sample from the area that will not be affected by rechannelization; (10) it appears that a high proportion of the total sample had some college education whereas the spouse of the household head tended to have less than a college education; (11) using education of the parents of the household heads as an index of upward mobility, it is apparent that the respondents in the sample were considerably better educated than their parents; (12) it appears that a large proportion of the sample has lived in their present dwelling less than 10 years, also

a high proportion of the sample own their own homes whereas they did not own their own homes prior to moving to their present dwelling.

In summarizing the comparative data of the two sub-samples the following conclusions were reached about socio-demographic factors of the residents in the areas directly affected by the rechannelization plans:

(1) a fewer number of household heads were employed;

(2) the educational level was lower, and was almost the same as their parents;

(3) almost one-half of the residents had lived there 3 years or less, but more than one-third had lived there over 11 years;

(4) almost two-thirds of the residents own their own houses although less than one-third previously owned their own home;

The use of Chi-square analysis of the differences of attitudes between the two sub-samples revealed the following significant features about the residents in the directly affected area:

(1) only one-half of the residents were satisfied with their neighborhood

(2) less than 20 percent would miss their neighborhood

(3) over one-half feel state and federal agencies are not helping their community

(4) over 80 percent felt conservation groups were not doing anything for them

Regarding those attitudes considered most important to the implementation of rechannelization plans, it was found that among the directly affected residents:

(1) only one-third are satisfied with flood control;

(2) over 90 percent felt rechanneling and levee building would reduce the hazards of flooding;

(3) less than one-half care to see the natural environment remain unchanged. (among the total sample 67.3 percent who did not want the environment changed do not live in the affected area)

(4) almost one-half approved relocation if necessary, and only 11 percent strongly disapproved.

In conclusion, the results of this study showed significant differences in a number of socio-demographic and attitudinal factors between the residents who would be directly affected by the proposed rechannelization and the "control" sample from other areas. These residents are of a lower socio-economic level, but most own their own homes. On the other hand, they have had problems with flooding, view rechannelization and/or levee building as needed, and would relocate if necessary.

These conclusions must be viewed in light of the fact that the response to the questionnaire was less than had been anticipated. Even though the sample size was rather small, approximately twenty-five percent of the families in the affected areas were interviewed. It is our opinion that there is no reason to believe that the other

three-fourths of the families would differ significantly from the random sample.

Based on the reported attitudes of the total sample (affected and non-affected residents of Dallas County) the following implications for the Elm Fork project are presented:

(1) action should be taken to alleviate the flooding from the waters of the Elm Fork;

(2) partial concrete channels, with extensive levee building appears to be the most acceptable of several alternatives listed in the questionnaire.

APPENDIX A

QUESTIONNAIRE

1. Sex (1) M___
   (2) F___

2. Age ____

3. Race ____

4. Marital Status
   (1) single ____
   (2) married ____
   (3) widowed ____
   (4) divorced ____
   (5) separated ____

5. Number of children and age
   (1) none ____
   (2) under 6 years old ____
   (3) 6 - 13 years old ____
   (4) 14 - 17 years old ____
   (5) 18 years old and over ____

6. Are you presently employed? Yes _____ No _____

7. What is your present work, or what is your usual work when you are employed? (Be specific.) ______________________________

8. Is your wife (husband) presently employed? Yes ____ No ____

9. What is her (his) present work, or usual work when she (he) is employed? (Be specific.) ______________________________

10. What is your total family yearly income? (Include income of spouse.)

   (0) under $1,000 ___
   (1) $1,000 to $1,999 ___
   (2) $2,000 to $2,999 ___
   (3) $3,000 to $3,999 ___
   (4) $4,000 to $4.999 ___
   (5) $5,000 to $5,999 ___
   (6) $6,000 to $7,999 ___
   (7) $8,000 to $9,999 ___
   (8) $10,000 to $14,999 ___
   (9) $15,000 to $19,000 ___
   (X) $20,000 to $24,999 ___
   (Y) $25,000 and over ___
   Don't know ___ No response ___

11. How many grades of school have you completed? ______

12. How many grades of school has your husband (wife) completed? ______

13. How many grades did your parents complete? (1) Father ____
    (2) Mother ____

14. How long have you lived in this house?

15. Do you own this home?
    (1) Own _____
    (2) Rent _____

16. Did you own or rent your former dwelling? (1) Own ____ (2) Rent ____

21. Considering everything, would you say you are satisfied or dissatisfied with this neighborhood as a place to live?
_____1. very satisfied
_____2. satisfied
_____3. neither satisfied or dissatisfied
_____4. dissatisfied
_____5. very dissatisfied

22. Do you ever wish you did not live here?
_____1. often
_____2. sometimes
_____3. seldom
_____4. never

23. Do you ever think to yourself, "This is a good neighborhood in which to live."?
_____1. often
_____2. sometimes
_____3. seldom
_____4. never

24. If you had to leave here for some reason and live someplace else, would you miss this neighborhood?
_____1. very much
_____2. some
_____3. not at all

25. About how often do you visit (i.e., dinner, parties, etc.) with people who live in this neighborhood?
_____1. daily
_____2. at least once a week
_____3. at least once a month
_____4. less than once a month
_____5. never
_____6. not applicable

26. About how often do you get together with people who live in other parts of the city, for example, not in this neighborhood?
_____1. daily
_____2. at least once a week
_____3. at least once a month
_____4. less than once a month
_____5. never

27. Do you think <u>your</u> home is more like the best possible home or more like the worst possible home in your neighborhood? Will you mark on this line about where you think your home is compared to the best and worst.

WORST ____ BEST
0 1 2 3 4 5 6 7 8 9 10

28. How much do you think each of the following groups is doing that is in the best interest of the people in your neighborhood?

1 = nothing   2 = some   3 = a lot

	Type of Organization	Example	Interest
1.	Charitable Organization	Red Cross, Salvation Army	1 2 3
2.	Civic Clubs	Rotary, Kiwanis	1 2 3
3.	Community Improvement Organization	Chamber of Commerce	1 2 3
4.	State Improvement Organization	Water Quality Board Trinity River Authority	1 2 3
5.	Social Clubs	Elks, Odd Fellows	1 2 3
6.	Veterans Groups	American Legion, VFW	1 2 3
7.	Federal Organizations	U.S. Army Corps of Engineers	1 2 3
8.	Conservation Societies	Sierra Club	1 2 3

29. Has your home, business, or other property been flooded by backup water from the Elm Fork of the Trinity or its tributaries:
(1) No _____   (2) If yes, which: (1) Home ___
(2) Business ___
(3) Other Property ___

30. Are you aware of plans to rechannel and levee the Elm Fork of the Trinity River? (1) Yes _____ (2) No _____

31. Where did you learn about these plans?
(1) Newspapers _____
(2) Television _____
(3) Friends _____
(4) Relatives _____
(5) Local organizations _____
(6) Local government _____
(7) State government _____
(8) Federal government _____

32. In your opinion will rechanneling and levee building reduce the hazards of flooding?
(1) Yes _____ (2) No _____ (3) Don't know _____

33. If the proposed construction on the Elm Fork involved relocation of your family or business, what would reaction be?
_____1. Strongly approve
_____2. Approve
_____3. Undecided
_____4. Disapprove
_____5. Strongly disapprove

34. Do you or any of your family utilize the Elm Fork of the Trinity River for:

(1) Business (1) Yes _____ (2) No _____
(2) Farming (1) Yes _____ (2) No _____
(3) Recreation (1) Yes _____ (2) No _____
(4) Other (1) Yes _____ (2) No _____
(Specify)_____________________________
(5) Do not utilize Elm Fork for any reason _____

35. The proposed flood control program involves channelization using concrete as well as earth levee building. In your opinion how should this program be implemented? Indicate your answer in both a and b.

a. (1) Total concrete channeling _____
(2) Partial concrete channeling _____
(3) No concrete channeling _____
b. (4) Total earth levee building _____
(5) Partial earth levee building _____
(6) No earth levee building _____

36. Would you prefer to see the natural environment of the Elm Fork remain unchanged? (1) Yes _____ (2) No _____

APPENDIX B

TABLE 1: The Relationship Between Locality of Residence and Age

Age	Directly Affected		Not Affected	
	N	%	N	%
18 - 39	24	48.9	31	41.9
40 - 59	16	32.7	34	45.9
59 and over	9	18.4	9	12.2
Total	49	100.0	74	100.0
X^2 = 2.060 d.f. = 2	Pr .20			

TABLE 2: The Relationship Between Locality of Residence and Employment Status

Employment	Directly Affected		Not Affected	
	N	%	N	%
Yes	30	62.5	59	79.7
No	18	37.5	15	20.3
Total	48	100.0	74	100.0
X^2 = 4.379 d.f. = 1	Pr .05			

TABLE 3: The Relationship Between Locality of Residence and Education Completed

Education	Directly Affected		Not Affected	
	N	%	N	%
0 to 10	24	49.0	7	9.6
10 to 12	13	26.5	22	30.1
Some College	12	24.5	44	60.3
Total	49	100.0	73	100.0
X^2 = 26.218 d.f. = 2	Pr .001			

TABLE 4: The Relationship Between Locality of Residence and Mother's Education

Education	Directly Affected		Not Affected	
	N	%	N	%
0 to 10	18	54.6	25	41.7
10 to 12	12	36.4	21	15.0
Some College	3	9.0	14	23.3
Total	33	100.0	60	100.0
X^2 = 3.313 d.f. = 2	Pr .20			

TABLE 5: The Relationship Between Locality of Resident and Father's Education

Education	Directly Affected		Not Affected	
	N	%	N	%
0 to 10	19	55.9	23	35.9
10 to 12	10	29.4	31	48.4
Some College	5	14.7	10	15.6
Total	34	100.0	64	99.9
X^2 = 3.276 d.f. = 2	Pr .20			

TABLE 6: The Relationship Between Locality of Resident and Length of Residence at Present Dwelling

Years	Directly Affected		Not Affected	
	N	%	N	%
3 years or less	21	44.7	26	36.2
4 to 10 years	9	19.2	34	47.2
11 years and over	17	36.1	12	16.6
Total	47	100.0	72	100.0
X^2 = 11.166 d.f. = 2	Pr .01			

TABLE 7: The Relationship Between Locality of Residence and Tenure

Tenure	Directly Affected		Not Affected	
	N	%	N	%
Own	31	63.3	61	83.6
Rent	18	36.7	12	16.4
Total	49	100.0	73	100.0

$X^2 = 6.513$ d.f. = 2 Pr .05

TABLE 8: The Relationship Between Locality of Residence and Tenure Status Prior to Moving into Present Dwelling

Former Dwelling	Directly Affected		Not Affected	
	N	%	N	%
Own	13	30.9	43	58.9
Rent	29	69.1	30	41.1
Total	39	100.0	73	100.0

$X^2 = 7.864$ d.f. = 2 Pr .02

TABLE 9: The Relationship Between Locality of Residence and Attitudes Toward Neighborhood

	Directly Affected		Not Affected	
	N	%	N	%
Satisfied	27	57.5	63	87.4
Indifferent	12	25.5	4	5.6
Dissatisfied	8	17.0	5	7.0
Total	47	100.0	72	100.0

$X^2 = 14.478$ d.f. = 2 Pr .001

TABLE 10: The Relationship Between Locality of Residence and Attitudes Toward Whether Neighborhood is Good

	Directly Affected		Not Affected	
	N	%	N	%
Frequently	25	53.2	64	87.6
Seldom	10	21.3	5	6.9
Never	12	25.5	4	5.5
Total	47	100.0	73	100.0

$X^2 = 17.836$ d.f. = 2 Pr .001

TABLE 11: The Relationship Between Locality of Residence and Sentiments Toward Neighborhood

Sentiment Toward Neighborhood	Directly Affected		Not Affected	
	N	%	N	%
Miss Neighborhood Very Much	8	17.0	24	32.9
Miss Neighborhood Some	27	57.4	39	53.4
Miss Neighborhood Not At All	12	25.6	10	13.7
Total	47	100.0	73	100.0

$X^2 = 4.963$ d.f. = 2 Pr .05

TABLE 12: Relationship Between Locality of Residence and Attitudes Toward the Involvement of Federal Organizations

	N	%	N	%
Nothing	21	56.8	22	39.3
Some	13	35.1	28	50.0
A Lot	3	8.1	6	10.7
Total	37	100.0	56	100.0

$X^2 = 4.316$ d.f. = 2 Pr .06

TABLE 13: Relationship Between Locality of Residence and Attitudes Toward The Involvement of Conservation Societies

Conservation Societies	Directly Affected		Not Affected	
	N	%	N	%
Nothing	29	82.9	34	61.8
Some	5	14.3	17	30.9
A Lot	1	2.8	4	7.3
Total	35	100.0	55	100.0
X^2 = 4.521 d.f. = 2	Pr .06			

TABLE 14: Relationship Between Locality of Resident and Attitudes Toward the Involvement of State Improvement Organizations

State Improvement Organizations	Directly Affected		Not Affected	
	N	%	N	%
Nothing	22	57.9	19	32.2
Some	15	39.5	35	59.3
A Lot	1	2.6	5	8.5
Total	38	100.0	59	100.0
X^2 = 7.409 d.f. = 2	Pr .03			

TABLE 15: The Relationship Between Locality of Residence and Attitudes Toward Water Supply

	Directly Affected		Not Affected	
	N	%	N	%
Satisfied	38	77.6	67	93.1
Undecided	10	20.4	3	4.2
Dissatisfied	1	2.0	2	2.7
Total	39	100.0	72	100.0
X^2 = 10.016 d.f. = 2	Pr .01			

TABLE 16: The Relationship Between Locality of Residence and Attitudes Toward Flood Control

	Directly Affected		Not Affected	
	N	%	N	%
Satisfied	16	35.6	53	82.8
Undecided	26	57.8	9	14.1
Dissatisfied	3	6.6	2	3.1
Total	45	100.0	64	100.0
X^2 = 25.769 d.f. = 2	Pr .001			

TABLE 17: The Relationship Between Locality of Residence and Attitudes Toward Sewage Disposal

	Directly Affected		Not Affected	
	N	%	N	%
Satisfied	24	63.2	58	85.2
Undecided	12	31.6	5	7.4
Dissatisfied	2	5.2	5	7.4
Total	38	100.0	68	100.0

$X^2 = 10.623$ d.f. = 2 Pr .01

TABLE 18: The Relationship Between Locality of Residence and Attitudes Toward Parks and Recreation

	Directly Affected		Not Affected	
	N	%	N	%
Satisfied	32	72.7	64	90.1
Undecided	9	20.5	5	7.1
Dissatisfied	3	6.8	2	2.8
Total	44	100.0	71	100.0

$X^2 = 5.461$ d.f. = 2 Pr .05

TABLE 19: The Relationship Between Locality of Residence and Attitudes Toward Environmental Protection

	Directly Affected		Not Affected	
	N	%	N	%
Satisfied	25	56.8	44	67.7
Undecided	15	34.1	12	18.5
Dissatisfied	4	9.1	9	13.8
Total	44	100.0	65	100.0
$X^2 = 3.578$ d.f. = 2	Pr .10			

TABLE 20: Relationship Between Locality of Residence and Attitudes Toward Rechanneling Trinity River to Reduce Hazards of Flooding

Rechannelization Reduces Hazards of Flooding	Directly Affected		Not Affected	
	N	%	N	%
Yes	37	94.9	51	94.4
No	2	5.1	3	5.6
	39	100.0	54	100.0
$X^2 = 1.451$ d.f. = 1	Pr .15			

TABLE 21: Relationship Between Locality of Residence and Attitudes Toward Relocation

Relocation	Directly Affected		Not Affected	
	N	%	N	%
Approve	21	45.7	27	39.1
Undecided	15	32.6	32	46.4
Disapprove	10	11.8	10	14.4
Total	46	100.1	69	99.9
$X^2 = 2.395$ d.f. = 2	Pr .16			

TABLE 22: Relationship Between Locality of Residence and Attitudes Toward Changing the Natural Environment

Prefer to Change	Directly Affected		Not Affected	
	N	%	N	%
Yes	16	38.1	33	51.6
No	26	61.9	31	48.4
Total	42	100.0	64	100.0
$X^2 = 1.192$ d.f. = 1	Pr .15			

PALEONTOLOGY

The valley of the Elm Fork of the Trinity River has experienced several periods of degradation alternating with periods of aggradation over the last 1,000,000 years. Although the exact triggering mechanism for these two opposing events along the upper Trinity Valley remains vague and speculative, we have made considerable headway concerning the identification of the periods represented by deposits, and therefore periods of aggradation. It is presumed that the periods not represented by alluvial deposits were actually the periods of rapid downcutting.

On the hilltops surrounding North Lake in the study area there are river cobbles of metaquartzites exotic to the present Trinity drainage. Menzer and Slaughter (1971) recently demonstrated that some of these, at least had their origin in the Manzano Mountains of northcentral New Mexico and speculated that they were brought here by a pre-Trinity river that flowed roughly from west to east, not unlike the present Red River, perhaps even emptying into the Mississippi River. This may have been either in late Pliocene or earliest Pleistocene times. As there are no known deposits that can be assigned to the Pleistocene prior to the next to last interglacial, the capture of this river by an early or proto-Trinity must have taken place during the Kansas epoch, perhaps some 600,000 years ago.

The third terrace above the present floodplain is not well exposed along the Trinity River although it can be identified

from its elevation above the modern floodplain. No identifiable bones have been recovered from this deposit and therefore its correct age remains unknown. It seems reasonable to assume that it represents a period of aggradation during the late Kansan and/or the Yarmouthian stages concerning the age of the next lower terrace. A fauna from these deposits would be of extreme importance but it is doubtful that the proposed work will offer additional exposures unless it is chosen to furnish materials for the levy itself.

The second terrace (T-2) above the present floodplain is much better known through the work of Slaughter, et al. (1962), Slaughter and Ritchie (1963), and Slaughter (1966). There is little doubt but that this period of aggradation belongs to the interglacial known as the Sangamonian some 75,000 years before present. The known fauna is large (Table 1) but many of the taxons are represented by very fragmentary remains and more and better specimens would be most welcome. Considering the sandy nature of the sediments of the T-1 terrace and the floodplain, it seems probable that the material for levy construction will be excavated from the T-2 terrace or the Cretaceous bedrock.

TABLE 1

Class Pelecypoda
  Order Prionodesmacea
    Crenodonta perplicata (Conrad)
    Quadrula speciosa (Lea)
    Truncilla truncata (Rafinesque)
  Order Teleodesmacea
    Sphaerium striatinum (Lamarck)
Class Gastropoda
  Order Mesogastropoda
    Amnicola integra (Say)
  Order Basommatophora
    Physa gyrina (Say)
    Gastrocopta armifera (Say)
    Gastrocopta procera (Gould)
    Gastrocopta contracta (Say)
    Gastrocopta pentodon (Say)
    Pupoides albilabris (Adams)
    Aplexia hypnorum (Linnaeus)
    Lymnaea dalli Baker
    Lymnaea caperata Say
    Lymnaea obrussa Say
    Lymnaea modicella (Say)
    Gyraulus circumstriatus (Tryon)
    Gyraulus parvus (Say)
    Menetus dilataus (Gould)
    Planorbula armigera (Say)
    Helisoma trivolvis (Say)
    Helisoma anceps (Menke)
    Carychium exiguum (Say)

Order Stylommatophora
  Hawaiia minuscula (Binney)
  Zonitoides arboreus (Say)
  Retinella indentata (Say)
  Stenotrema leai (Binney)
  Mesodon thyroidea (Say)
  Polygyra texasiana (Moricand)
  Bulimulus dealbatus (Say)
  Helicina orbiculata tropica Pfeiffer
  Helicodiscus parallelus (Say)
  Strobilops texasiana (Pilsbry and Ferris)
  Succinea avara Say
Class Insecta
  Order Coleoptera
    Family Carabidae
    Family Elateridae
    Family Chrysomelidae
  Order Hymenoptera
  Order Orthoptera
Class Diplopoda
Class Crustacea
  Order Mysicacea
Class Osteichtyes
  Order Lepisosteiformes
    Lepisosteus sp. cf. *L. spatula* (Lacepede), alligator gar
    Lepisosteus sp., long-nosed or short-nosed gar
  Order Cypriniformes
    Ictiobus sp., buffalo fish
    Pylodictis olivaris (Rafinesque), flathead catfish

    Ictalurus punctatus (Rafinesque), channel catfish
    Aplodinotus grunniens Rafinesque, freshwater drum
Class Reptilia
  Order Testudinata
    Graptemys geographica (Le Sueur), map turtle
    Terrapene carolina (Linnaeus), Carolina box turtle
    Geochelone sp. cf. *G. crassiculata*, giant tortoise
    Trionyx sp., soft-shelled turtle
  Order Crocodilia
    Alligator mississippiensis (Daudin), alligator
  Order Squamata
    Coluber constrictor (Linneaus), racer
Class Amphibia
  Order Anura, frog
Class Aves
  Order Falconiformes
    Aquila chrysaetos (Linnaeus), golden eagle
  Order Galliformes
    Tympanuchus sp., prairie chicken
  Order Passeriformes
    Corvus brachyrhnchos Brehm, crow
  Order Strigiformes
    Tyto alba (Scopoli), barn owl
Class Mammalia
  Order Marsupialia
    Didelphis marsupialis Linnaeus, opossum
  Order Insectivora
    Scalopus aquaticus (Linnaeus), mole
    Cryptotis parva (Say), least shrew
  Order Endentata
    Megalonyx sp. cf. *M. brachycephalus* McAnulty, sloth
    Holmensina septentrionalis (Leidy), extinct armadillo
    Dasypus bellus (Simpson), beautiful armadillo
  Order Rodentia
    Sciurus carolinensis Gmelin, eastern gray squirrel
    Spermophilus tridecemlineatus (Mitchell), thirteen-lined ground squirrel
    Peromyscus sp. cf. *P. leucopus* (Rafinesque), white-footed mouse

    Neotoma floridana (Ord), florida wood rat
    Sigmodon hispidus Say and Ord, common cotton rat
    Microtus pinctorum (Le Conte), pine vole
    Ondatra zibethicus (Linnaeus), muskrat
    Geomys bursarius (Shaw) plains pocket gopher
    Castor canadensis (Linnaeus), beaver
  Order Lagomorpha
    Sylvilagus sp. cf. *S. floridanus* (Allen), cottontail rabbit
  Order Carnivora
    Vulpes fulva (Desmarest), red fox
    Canis latrans sp. cf. *C.l. harriscrooki* Slaughter, coyote
    Aenocyon sp. cf. *A. dirus* (Leidy), dire wolf
    Ursus americanus Pallas, black bear
    Arctodus sp. cf. *A. simus* (Cope), short-faced bear
    Procyon lotor (Linnaeus), raccoon
    Mustela vison (Bangs), mink
    Mephitis mephitis (Schreber), striped skunk
    Smilodon fatalis (Leidy), sabre-toothed cat
    Felis sp. cf. *F. inexpectata* (Cope), extinct puma
    Lynx rufus (Schreber), bobcat
  Order Proboscidea
    Mammut americanus (Kerr), American mastodon
    Elephas columbi Falconer, Columbian mammoth
  Order Artiodactyla
    Platygonus compressus Le Conte, Le Conte's peccary
    Odocoileus virginianus aplodon Slaughter, simple-toothed whitetail deer
    Breameryx sp., extinct antelope
    Tetrameryx shuleri Lull, Shuler's antelope
    Camelops huerfanensis dallasi Lull, Dallas camel
    Tanupolama mirifica Simpson, wonderful llama
    Bison sp. cf. *B. chaneyi* Cook, giant bison
  Order Perissodactyla
    Tapirus copei Simpson, Cope's tapir
    Equus conversidens (Owen), Mexican ass
    Equus midlandensis Quinn, Midland horse
    Equus? quinni Slaughter, Quinn's horse
    Equus sp. cf. *E. lambei* Hay, Lambe's horse

The elevation usually considered the top of the T-1 terrace is abundantly represented in the study area. Abundant artifacts found in the upper portion of this terrace has led to speculation that the terrace is rather young, say less than 10,000 years B.P. However, recent work seems to indicate that these were worked into the sandy surfacial material post-deposition even though there seems to have been a rather mature soil profile developed after the artifacts were introduced. Buried beneath the recent deposits of the floodplain there are sands and gravels we now know to have been deposited slightly more than 22,000 years ago. It seems probable that these are actually the basal sediments of the T-1 terrace and the total section has been eroded considerably when downcutting circa, say 25,000 + was underway. This period of downcutting was somewhat less severe than those previous and did not remove the previous floodplain deposits. Although this is an extremely important period considering some archeologists now think it is to be included in the age of man in America, little is known of the period due to few available exposures and the high water table. The only identifications of vertebrate remains from the deposit are *Bison antiquus* (extinct bison), *Mammuthus columbi* (Columbian Mammoth), and *Mammut americanus* (Mastodon). However, a recent molluscan fauna was described by Willimon (1971) (Table 2) just downstream which indicates the period was characterized by somewhat cooler climate than current in the area. Extensive faunal and stratigraphic studies should be undertaken when these deposits are exposed by the proposed work.

Deposits circa 12,000 - 9,500 B.P. are suspected as occurring as shallow channel fills superimposed on the buried Pleistocene deposits described above. They have not been identified with certainty along the Trinity River due perhaps to the lack of workable exposures. These deposits have been studied by Slaughter and Hoover (1963) along the Sulphur River northeast of Dallas. It is exceedingly important to identify such deposits and study them in detail. The Sulphur River deposits of this age have produced the only artifacts of Clovis-Folsom age found in place this far east in Texas. Perhaps a more productive locality will be forthcoming when there are better exposures. The fauna of this deposit also indicates somewhat cooler summers than are current, but surprisingly, the winters must have been at least as mild as they are today, perhaps even warmer.

TABLE 2

KINGDOME PLANTAE

Phylum CHLOROPHYTA
Class CHAROPHYCEAE
ORDER CHARALES
cf.Chara vulgaris Kerneri
cf.Chara baueri Braun

KINGDOME ANIMALIA

Phylum MOLLUSCA
Class GASTROPODA
(Aquatic Species)
Order PULMONATA Cuvier
Family PHYSIDAE Dall
Physa virgato Gould
Family ANCYLIDAE Menke
Gundlachia meekiana Stimpson
Family LYMNAEIDAE Broderip
Lymnaea bulimoider Lea
Family PLANORBIDAE Adams
Helisoma trivolvis (Say)
Helisoma anceps (Menke)
Gyraulus parvus (Say)
Gryaulus circumstriatus (Tryon)
Promenetus kansasensis (Baker)
Tropicorbis obstructus (Morelet)
Family VALVATIDAE Gray
Valvata tricarinata (Say)
Order CTENOBRANCHIATA Scheigger
Family AMNICOLIDAE Gill
Amnicola limosa (Say)
Somatogyrus subglobosus (Say)
(Terrestrial Species)
Order PULMONATA Cuvier
Family PUPILLIDAE Turton
Gastrocopta cristata (Pilsbry and Vanatta)
Gastrocopta armifera (Say)
Gastrocopta procera (Gould)
Gastrocopta pellucida horbeacella Pilsbry
Gastrocopta tappaniana (Adams)
Gastrocopta pentodon (Say)
Gastrocopta contracta (Say)
Vertigo ovata (Gould)
Vertigo milium (Gould)
Pupoides albilabris (C.B.Adams)
Family STROBILOPSIDAE Hanna
Strobilops texasiana (Pilsbry and Ferriss)
Family ENDODONTIDAE Pilsbry
Helicodiscus parallelus (Say)
Family VALLONIIDAE Pilsbry
Vallonia gracilicosts (Reinhardt)
Vallonia parvula (Sterki)
Family CARYCHIIDAE Jeffreys
Carychium exiguum (Say)
Family ZONITIDAE Pilsbry
Hawaiia minuscula (Binney)
Zonitoides arboreus (Say)
Zonitoides nitidus (Müller)
Family POLYGYRIDAE Pilsbry
Polygyra texasiana (Moricand)
Family SUCCINEIDAE Beck
Succinea sp.
Class PELECYPODA
Order TELEODESMACEA
Family SPHAERIIDAE Dall
Sphaerium striatinum (Lemark)
Family PISIDUM C. Pfeiffer
Pisidium mitidum (Jenyns)

Phylum ARTHROPODA
Class CRUSTACEA
Order PODOCOPIDA
Family ILYOCYPRIDIAAE
cf. Pelecypris sp.
cf. Potamocypris sp.

Phylum CHORDATA
Class MAMMALIA
Order ARTIODACTYLA
Family BOVIDAE Gray
Bison (Simobison) antiquus (Leidy)
Order PROBOSCIDEA
Family ELEPHANTIDEA
Mammuthus sp.

One of the most mysterious facts to come out of S.M.U. studies of the Trinity River drainage is that the channels were some fifty feet below their present grade just over 2,500 years ago and began to fill rapidly about that time. The reason for this sudden aggradation remains unknown. There was apparently little, if any, rise in sea level at that time and it was too early for man's agricultural activities to have any effect. Additional information on this even is sorely needed but there are no known exposures available now. The proposed work should allow further study of this interesting aspect of Trinity River history.

Conclusions and Recommendations

1. It is doubtful that the proposed work will aid our meager knowledge of the proto-Trinity River or the T-3 terrace, unless the latter is exposed for levy material, which seems improbable.
2. Considering the sandy nature of the floodplain deposits, it seems likely that the material for the levys will be taken from the T-2 terrace or the Cretaceous bedrock (Eagle Ford Shale). In either case, it is almost certain that important fossil vertebrate remains will be available if properly prospected. The Eagle Ford Shale has already produced new forms of marine fishes less than a mile from the study area near Coppell. Likewise, a S.M.U. graduate student has recently studied a locality producing Pleistocene vertebrate remains from the same area which probably represents a T-2 terrace

equivalent of the T-2 terrace. His work produced many of the animals listed in Table 1. Any such exposures should certainly be watched by a paleontologist.

3. Perhaps the most important possibilities of the proposed work is the availability of rare exposures of the basal T-1 terrace and possible channel fillings. These two deposits are ill-understood and represent very critical stages in the animal and human life in North America.
4. Any additional information the proposed excavations might shed on the rapid aggradation of the Trinity valley just 2,500 years ago would be welcome. Although the fact is well established, the reason for such valley-filling prior to agricultural man without significant change in sea level, remains a mystery.

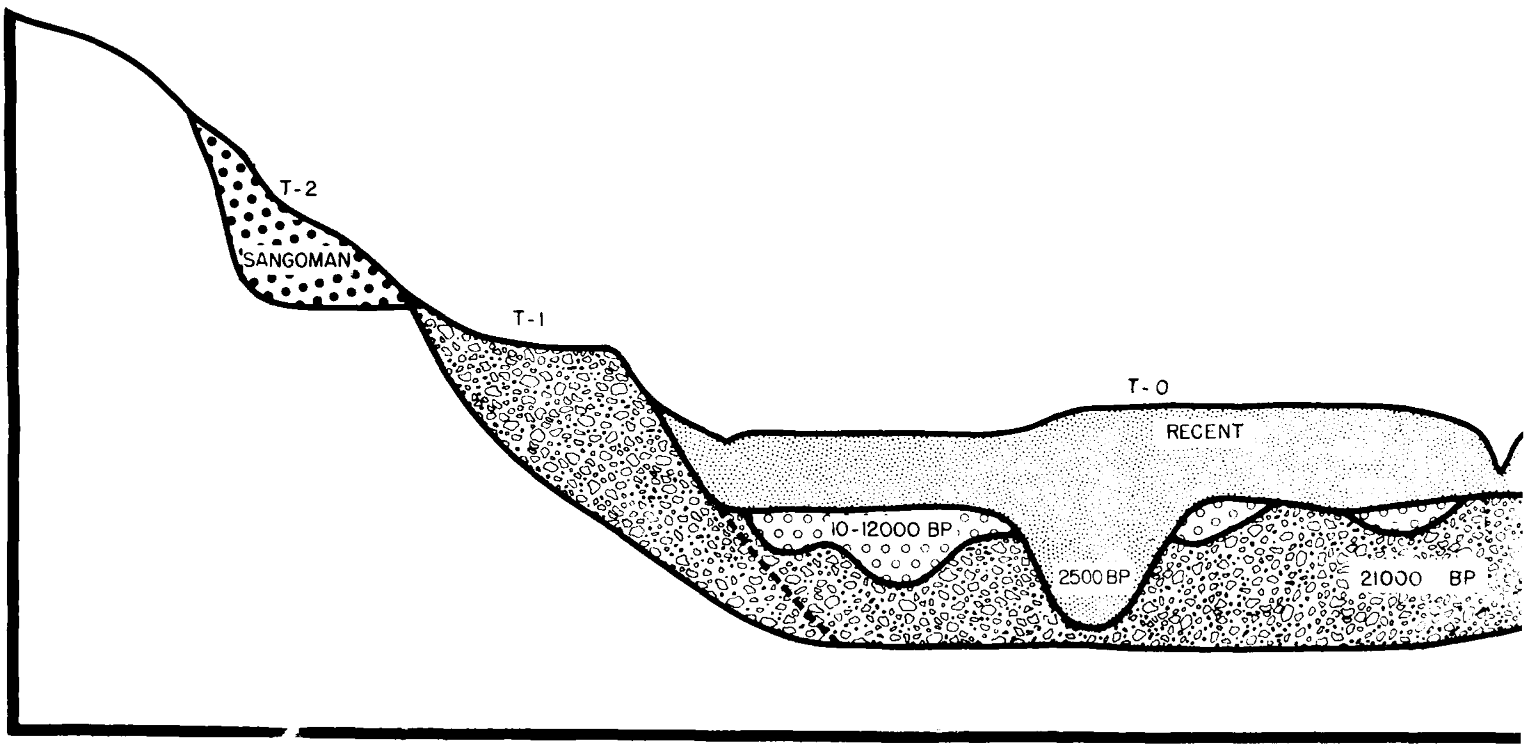
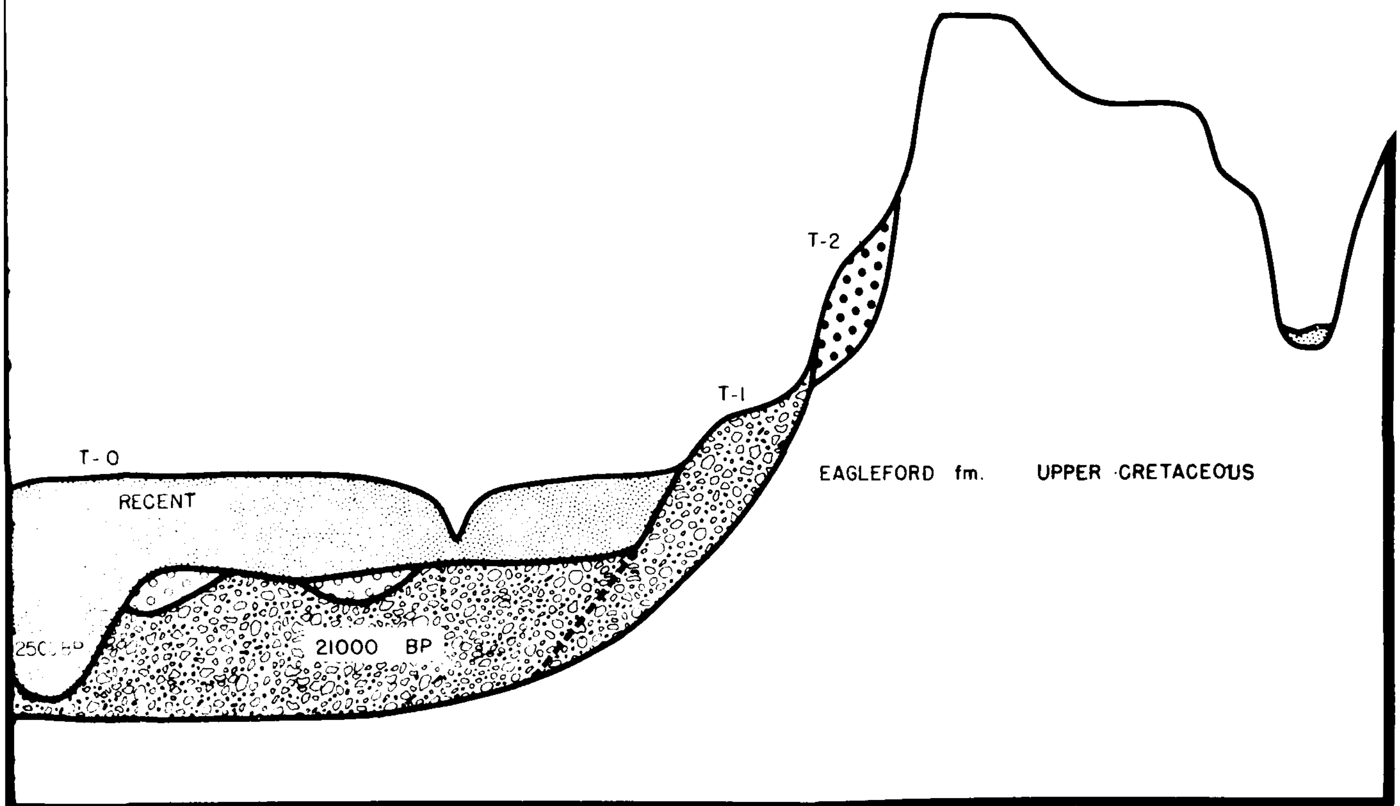


Fig. 2 SCHEMATIC CROSS SECTION OF THE ELM FORK OI

CARROLLTON QUADRANGLE , T



N OF THE ELM FORK OF THE TRINITY RIVER

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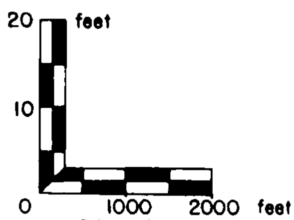

SCALE

VERTICAL EXAGGERATION = 100

SECTION II

AQUATIC ECOLOGIC IMPACT STUDY

OF THE ELM FORK REGION

AQUATIC ECOLOGIC IMPACT STUDY
OF THE ELM FORK REGION

Introduction

Intensive reconnaissance and field collections were conducted in the study area during August and September, 1971. The heavy rains occurring during October and high subsequent runoff followed by large releases of water from Lewisville and Grapevine reservoirs prevented adequate field work from being conducted during the remaining months of the study. These high water conditions resulted in substantial dispersal of the aquatic animal populations making a complete species inventory impossible. However, the early collections, site references from museum collections, and available literature provide a reasonable qualitative community structure from which predictions of the channelization impact can be made.

Acknowledgments

I wish to thank the following students who assisted with the net collections: Joan DeBusk, Jerry Glidewell, Clark Hellier, Mark Kelly, Faust Parker and Marlin Rogers. Lloyd Pratt kindly identified the clam specimens.

Methods

Collections were made at several locations from Backman Creek upstream to the mouth of Prairie Creek. The greatest emphasis was placed on the area upstream from the I35 highway bridge due to the availability of seining locations in this stretch of the river.

Most collections were made with either a 15-foot seine with 1/4-inch mesh on a 4-foot drop, or with a 50-foot seine also with 1/4-inch mesh on a 6-foot drop and with a 6-foot bag in the center. Other types of collecting gear used included gill nets and wire traps baited with liver. Several local fishermen were kind enough to let me examine their catches.

Faunal Survey

The most intensive collections made during this survey involved the fish fauna. Twenty-five species of fishes were collected in the Elm Fork (Table I) during the present study. Hubbs (1961) lists 52 species which should be expected to occur in the area of the Elm Fork. The Elm Fork is rather unique in that it drains both the Eastern Cross Timbers and the Blackland Prairie having a consequent large number of fish species. This fork of the Trinity River System also represents the only major stream with substantial flow in the immediate Dallas area having water quality capable of supporting a broadly diversified fish fauna. In addition to the species collected in the present study several additional species have been reported from the Elm Fork by Bonn (1956) and Lamb (1957). Table II.

A few are deposited in the Texas A. & M. University fish collection, and several species known to occur in Garza-Little Elm and Grapevine reservoirs have been reported to the survey team by local fishermen as being taken in the study area. Two local fishermen claim to have recently taken "catfish" weighing from 30 to 50 pounds on set lines in the river. If this is true the fish must have been

Pylodictus olivaris the flathead catfish.

The fall flood conditions and subsequent release of water from Lewisville and Grapevine dams into the winter months prevented planned quantitative benthic sampling. However, qualitative samples scooped from the river bed using a screen bottomed bucket yielded a few specimens of mayfly larv e. Further large species populations of clams belonging to the genera Truncilla and Quadrillo were observed during seining operations. The rather stable flow characteristics introduced by controlled releases of water for maintaining the Dallas water supply should favor benthic development. The above mentioned clam populations occurring primarily in shallower areas of the river above the Interstate 35 highway bridge are filter feeders capable of removing substantial quantities of organic matter from the water column. It is quite possible that these organisms play a significant role in maintaining water quality in the Elm Fork.

Discussion

The effects of channelization on the stream environment have been reported by several authors including Burns (1972), Elser (1968) and Tarplee *et al* (1971). These effects generally fall into the categories of water temperature increase from removal of forest canopies, increased turbidity, reduction in fish productivity, and severe reduction in benthos. The following discussion is in reference to the possible impact of channelization on the Elm Fork in light of the above mentioned effects.

The fish populations would be reduced in size and the individual

size of sports fish would probably decline. Several species of fishes would probably be restricted from the channelized portions of the stream. These would be species dependent on the pool riffle sequence in the unaltered stream channel. Cross (1967) lists strong preference for this habitat type by the following species reported from the Elm Fork; *Notropis atherinoides*, *N. umbratilis*, *N. buchanani*, *Hybognathus placita*, *Campostoma anomalum*, *Fundulus kansae* and *Percina scierus*.

None of these species are endemic to the river. They are now maintaining populations from the Carrollton Dam upstream to the Lewisville Dam. Their loss would result in a significant decrease in species diversity in one of the more diverse streams in the Dallas area.

Of greater significance would be the loss in benthic populations and the decreased retention time for water in the stream channel due to the shortening and widening of the channel. The soil types in the Elm Fork drainage, described in the stratigraphic section of this report, are subject to heavy erosion particularly when the forest cover is removed. This conclusion is drawn from the erosion can study described in the terrestrial ecology section of this report and from the Springer Plan report (Springer, 1969). The erosion resulting from the channelization project should result in higher turbidity levels in the river. It is doubtful whether the above mentioned clam populations could be maintained under the stress of significantly increased turbidity loads. The Springer

Plan (Springer, 1969) points out that the Elm Fork serves as the raw water route for the Carrollton, Backman and Park cities water plants and that this function must be considered primary, with flood control and recreational development secondary to the water supply function. The principal pollution source found in the Elm Fork was the effluent discharge of the Lewisville Sewage Treatment Plant entering the river through Prairie Creek. With the rapid urbanization occurring in the Lewisville area this source could become highly significant in the near future requiring the full assimilative capacity of the Elm Fork for purification. Any decrease in normal biological activity could adversely affect the Dallas city water supply particularly during low water periods. As further pointed out in the Springer Report regulated recreational use of the river appears to be compatible with the water supply function.

The Elm Fork from Lewisville Dam to its confluence with the Trinity at Dallas and its adjacent flood plain represents one of the most vital links in the environmental corridor system recommended in the 1972 Open Space Plan prepared and approved by the North Central Texas Council of Governments.

TABLE I. Fishes Collected in Present Study.

<u>Lepisosteus</u> <u>osseus</u> (Linnaeus) - long-nosed gar

<u>Dorosoma</u> <u>petenense</u> (Gunther) - threadfin shad

<u>Dorosoma</u> <u>cepedianum</u> (LeSueur) - gizzard shad

<u>Notemigonus</u> <u>crysoleucas</u> (Mitchell) - golden shiner

<u>Notropis</u> <u>venustus</u> (Girard) - blacktail shiner

<u>Notropis</u> <u>lutrensis</u> (Baird and Girard) - red shiner

<u>Notropis</u> <u>atrocaudalus</u> Everman - blackspot shiner

<u>Pimephales</u> <u>vigilax</u> (Baird and Girard) - bullhead minnow

<u>Ictalurus</u> <u>punctatus</u> (Rafinesque) - channel catfish

<u>Ictalurus</u> <u>melas</u> (Rafinesque) - black bullhead

<u>Noturus</u> <u>nocturnus</u> (Jordan and Gilbert) - freckled madtom

<u>Fundulus</u> <u>notatus</u> (Rafinesque) - blackstripe topminnow

<u>Gambusia</u> <u>affinis</u> (Baird and Girard) - mosquitofish

<u>Menidia</u> <u>audens</u> Hay - Mississippi silverside

<u>Roccus</u> <u>chrysops</u> (Rafinesque) - white bass

<u>Micropterus</u> <u>punctulatus</u> (Rafinesque) - spotted bass

<u>Micropterus</u> <u>salmoides</u> (Lacepede) - largemouth bass

<u>Chaenobryttus</u> <u>gulosus</u> (Cuvier) - warmouth

<u>Lepomis</u> <u>macrochirus</u> Rafinesque - bluegill

<u>Lepomis</u> <u>megalotis</u> (Rafinesque) - longear sunfish

<u>Pomoxis</u> <u>annularis</u> Rafinesque - white crappie

<u>Percina</u> <u>scierus</u> Swain - dusky darter

<u>Percina</u> <u>caprodes</u> (Rafinesque) - logperch

<u>Etheostoma</u> <u>spectabile</u> (Agassiz) - orange throat darter

<u>Aplodinotus</u> <u>grunniens</u> Rafinesque - freshwater drum

TABLE II. Checklist of Species Found in Garza-Little Elm Reservoir and Elm Fork Trinity Drainage by Bonn (1956) and Lamb (1957).

Lepisosteus platostoma Rafinesque - shortnose gar

Lepisosteus productus (Winchell) - spotted gar

Lepisosteus osseus (Linnaeus) - longnose gar

Dorosoma cepedianum (LeSueur) - gizzard shad

Astyanas fasciatus (Cuvier) - banded tetra

Ictiobus bubalus (Rafinesque) - smallmouth buffalo

Carpiodes carpio (Rafinesque) - river carpsucker

Mineytrema melanops (Rafinesque) - spotted sucker

Cyprinus carpio Linnaeus - carp

Notemigonus crysoleucas (Mitchell) - golden shiner

Opsopoeodus emiliae Hay - pugnose minnow

Notropis atherinoides Rafinesque - emerald shiner

Notropis umbratilis (Girard) - redfin shiner

Notropis lutrensis (Baird and Girard) - red shiner

Notropis buchanani Meek - ghost shiner

Notropis venustus (Girard) - blacktail shiner

Notropis brazosensis Hubbs and Bonham - Brazos River shiner

Hybognathus nuchalis Agassiz - silvery minnow

Hybognathus placita Girard - plains minnow

Pimephales vigilax (Baird and Girard) - bullhead minnow

Campostoma anomalum (Rafinesque) stoneroller

Ictalurus punctatus (Rafinesque) - channel catfish

Ictalurus melas (Rafinesque) - black bullhead

TABLE II. Checklist of Species Found in Garza-Little Elm Reservoir and Elm Fork Trinity Drainage by Bonn (1956) and Lamb (1957). (continued)

<u>Ictalurus</u> <u>natalis</u> (LeSueur) - yellow bullhead

<u>Noturus</u> <u>mollis</u> (Mitchell) - tadpole madtom

<u>Noturus</u> <u>nocturnus</u> (Jordan and Gilbert) - freckled madtom

<u>Fundulus</u> <u>notatus</u> (Rafinesque) - blackstripe topminnow

<u>Fundulus</u> <u>kansae</u> Gorman - plains killifish

<u>Gambusia</u> <u>affinis</u> (Baird and Girard) - mosquitofish

<u>Roccus</u> <u>chrysops</u> (Rafinesque) - white bass

<u>Micropterus</u> <u>punctulatus</u> (Rafinesque) - spotted black bass

<u>Micropterus</u> <u>salmoides</u> (Lacepede) - largemouth black bass

<u>Chaenobryttus</u> <u>gulosus</u> (Cuvier) - warmouth

<u>Lepomis</u> <u>cyanellus</u> <u>Rafinesque</u> - green sunfish

<u>Lepomis</u> <u>macrochirus</u> <u>Rafinesque</u> - bluegill

<u>Lepomis</u> <u>humilis</u> (Girard) - orangespotted sunfish

<u>Lepomis</u> <u>microlophus</u> (Gunther) - redear sunfish

<u>Lepomis</u> <u>megalotis</u> (Rafinesque) - longear sunfish

<u>Pomoxis</u> <u>annularis</u> Rafinesque - white crappie

<u>Percina</u> <u>caprodes</u> (Rafinesque) - logperch

<u>Etheostoma</u> <u>chlorosoma</u> (Hay) - bluntnose darter

<u>Etheostoma</u> <u>gracile</u> (Girard) - slough darter

<u>Etheostoma</u> <u>barratti</u> Holbrook - scalyhead darter

<u>Etheostoma</u> <u>spectabile</u> (Agassiz) - orangethroat darter

<u>Aplodinotus</u> <u>grunniens</u> Rafinesque - drum

SECTION III

TERPESTRIAL ECOLOGIC IMPACT STUDY OF

THE ELM FORK REGION

TERRESTRIAL ECOLOGIC IMPACT STUDY OF THE ELM FORK REGION

Introduction

This study involved about 30 river miles of the Elm Fork from its confluence with the Trinity River in Dallas County northwestward to the Lewisville Dam at Garza-Little Elm Reservoir in Denton County. Field work was conducted from August, 1971, to March, 1972. The preponderance of field data was obtained in late summer with periodic checks of selected sites (See Plats 1-3) during subsequent months. The immediate banks of the Elm Fork as well as the flood valley and terraces were sampled. I regret that this study will be the last authorized for this waterway because the data are not sufficient for an in-depth investigation. In realization of this fact I present my findings and recommendations at the termination of this report knowing that the conclusions can be no more than generalized and somewhat tentative.

Acknowledgments

I am most indebted to members of the terrestrial ecology team who devoted much time and energy to this project: Joan DeBusk, Marlin Rogers, Steve McDaniel and Robert Lamoreaux. A special debt of gratitude is due Dr. Robert Neill, Professor of Botany, who actively participated in study of lowland vegetation and aided indentification of bird species. Dr. Louis Bragg, Professor of Botany, was most helpful in identification of grasses and correlation of geologic formations with plant communities. Dr. W. F. Pyburn,

Professor of Zoology, aided importantly in analysis of amphibians and reptiles and Dr. Warren Pulich, University of Dallas, a nationally eminent ornithologist provided valuable data on residential and migratory birds of the Elm Fork area. As mentioned previously, all investigative teams are indebted to Mr. L. E. Horsman, U. S. Corps of Engineers for his many acts of assistance and encouragement during the tenure of this study.

Description of Area

As the topography of the area has been dealt with in an earlier section of this report, I will be quite brief in my description and emphasize the correlation of major plant communities with topography. From confluence with the West Fork Trinity River on the east, the Elm Fork transects about 20 river miles through Blackland Prairie (Tharp, 1926, 1952). The Blackland Prairie once supported a tall grass community (Dykstehuis, 1946; Hill, 1887, 1901; Steiger, 1930) highlighted by Indian Grass (*Sorghastrum nutans*, to seven feet) and Little Blue Stem (*Andropogon scoparius*); essentially all the Elm Fork Blackland Prairie is now in some degree of stress and is dominated by Little Blue Stem (*Andropogon scoparius*), Buffalo grass (*Buchloe dactyloides*) and curly mesquite (*Hilaria belangeri*). Approximately the next 10 river miles northwest, the Elm Fork transects the Eastern Cross Timbers (Dykstehuis, 1948; Gould, 1962) dominated by Blackjack Oak (*Quercus marilandica*) and Postoak (*Quercus stellata*) with Little Blue Stem grass as chief understory. In general, the grasslands occur on dark, clayey soil (Carter, 1931)

which has developed from Houston-Wilson group of the Eagle Ford Shale Series; the cross-timbers occur on reddish, sandy soils evolved from Kirvin-Norfolk Group of the Woodbine Sandstone Series. Both grasslands and cross-timbers are somewhat evident along the Elm Fork lowlands and more so on the upland terraces. Much of the Eastern Cross Timbers have been decimated by human activity and the Blackland Prairie has been badly mismanaged so that pristine stands of tall grass species are extremely rare and spotty. The most noteworthy vegetative system is the mesophytic forest of hardwoods which line the immediate banks and lowlands of the Elm Fork. This is a unique riparian forest in the sense that it is a modified extension of East Texas forests westward. This plant community is typified by a rich variety of tree species and requires a high humidity microenvironment. This community is most diverse including significant numbers of the following canopy trees: Cedar Elm (*Ulmus crassifolia*), Hackberry (*Celtis*), *Bumelia*, and Box Elder (*Sambucus*), at least species of Ash (*Fraxinum*) and Hickory (*Carya*). Sub-canopy trees include Hawthorne (*Crataegus*), Osage-Orange (*Maclura*), and Creeper (*Parthenocissus*) with an understory dominated by a grass (*Uniola latifolia*), Greenbrier (*Smilax*) and Coralberry (*Symphoricarpus*). Coralberry is an especially good indicator of mesic conditions. Unfortunately this rather spectacular forest is rapidly diminishing due to human enterprise. The mesophytic forest replaces the Eastern Cross Timbers along the northwest Elm Fork banks like twin ribbons 10 to 200 meters in width. The Elm Fork drainage area includes

portions of four counties from its inception in Cooke and Grayson counties, southeast through Denton County to its confluence in Dallas County. The river meanders widely throughout its valley and has deposited rich alluvium in its flood-plain.

Methods

Microenvironmental factors were measured with a portable, battery-driven hygrometer to reveal relative humidity values and a portable Yellow-Springs electronic telethermometer which yielded temperature measurements to the nearest 0.5°C. Soil samples along altitudinal gradients were tested for percent soil moisture (the nearest 0.1%). Litter microfauna was examined by means of Tulgren Filters utilizing a 25 watt bulb as a heat source and gradually advancing the heat source toward the sample over a period of 72 hours. Litter microfauna was collected by this method in small vials of alcohol and examined with a dissecting microscope. Tin cans were buried at selected sites to furnish information on rates of top-soil erosion. Most of the length of the Elm Fork was traversed by boat during which topographic features and larger vertebrates and arthropods were identified either by direct observation or in some cases by sign. Sherman live traps were set to sample small rodent populations. The entire area of study was driven by private automobile several times but there are very few roads which avail close transportation to the Elm Fork other than a few highway bridges across this river. Aerial photographic maps were helpful to some degree but this overflight was conducted in Spring, 1970, and personal observation

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indicated significant changes in pertinent terrestrial areas since that time. Topographic maps (U. S. Geologic Survey) were useful in a general way but these were last up-dated in 1958. Published and unpublished reports on terrestrial organisms of the Elm Fork are rare and were not very helpful because of their incompleteness and in some cases their consideration of only 'game' species. Flood-plain forests were examined using the transect sampling technique and grassland species were identified by transporting specimens to the laboratory where professional botanists were most helpful.

Results

1. MICROCLIMATES - Standard meterologic data are of restricted usefulness in ecologic studies. Climatic regimes which occur in the immediate vicinity of populations and are of operational significance (Mason and Langenheim, 1957) to the organisms are ecologically relevant and are termed microclimates.

   A. Relative Humidity - A portable hygrometer was utilized in the field. Measurements recorded on the floor of the mesophytic forests were typically 12 to 18% higher than those recorded at a height of two meters in open sunlight (weather bureau reports) and 15 to 25% higher than recordings taken on bare open soil. Readings taken on the floor of the grasslands were 5 to 9% lower than the forest but were at least 5% higher than two-meter height. Emphasis is placed on ground level humidities because virtually all plant seedlings emerge into this zone and most animal species

(arthropods, most small vertebrates) dwell here. It is of great importance also because microbes are concentrated at the air-ground interface and these organisms are absolutely essential in nutrient cycling. Typical summer noon readings (+ or - 5%) were: Forest floor - 49%, Grassland floor - 40%, bare soil floor in sun - 30% and grassland two meter height in open sunlight - 35%.

B. Temperatures - A battery-operated telethermometer was utilized in the field. Weather Bureau temperatures are recorded at 1.5 to 2.0 meters in open space. Typical summer noon micro-climate temperatures (+ or - 0.5°C.) were: Forest floor - 27°C., Grassland floor - 36°C., bare soil floor in sun - 55°C., and Grassland two meter height open sunlight - 40°C.

C. Light - No actual photometer records were taken. It is essential to realize that seasonal light intensities within a dedicuous forest are the reverse of open space, i.e., a dedicuous forest floor experiences increasing light intensities from October (leaf fall) to a maximum in February then light intensity diminishes (as leaves bud) gradually in March and reaches a minimum in June - August. Numerous organisms are sensitively adapted to this 'reverse rhythm' photoperiodicity.

D. Soil Moisture Gradients - An Ohaus moisture analyzer was utilized to determine percent soil moisture. Samples from two depths were taken in transect from a point one meter

from the water's edge (sampe #1) to a point 18 meters inland in mesophytic forest and in an old-field grassland (under a power line). The data reflect moisture retension, evaporation rate and to a lesser extent sub-soil seepage. Sample interval was 3 meters in the forest and 6 meters in the grassland. Soil moisture, within limits, is important in microbe recycling rates. Data are presented in tabular form below.

	MOSOPHYTIC FOREST			OLD-FIELD GRASSLAND	
Depth	15 cm.	30 cm.		15 cm.	30 cm.
Sample #1	23.5%	22.3%	#1	16.0%	14.5%
#2	22.2%	24.7%	#2	13.1%	15.3%
#3	19.4%	20.0%	#3	12.7%	18.9%
#4	22.7%	18.4%			
#5	19.2%	20.7%			
#6	11.5%	18.6%			

2. LITTER MICROFAUNA - Tulgren Filters were utilized to examine litter microfauna. Litter samples from mesophytic forest floor and grassland floor did not yield satisfactory results. Heat increase rate may have been too high. In any case the total estimated number of spiders, millipedes and Oribatid Mites was much greater in the forest sample, as expected. Although too large to be termed 'microfauna', crayfish signs were fairly common in the forest but none seen in grasslands. All these organisms are of great importance in detritus degradation hence nutrient cycling (Odum and de la Cruz, 1963).

3. TOP-SOIL EROSION - Number 10 tin cans were buried flush with the ground at selected sites on Elm Fork bank crest in mesophytic forest and in old-field grassland. The results were an alarming indication of what happens where the forest is eradicated. After a period of only four months and precipitation of about six inches, 17 mm. of top-soil washed into the forest can while 22 mm. of top-soil washed into the can placed in the disturbed area. A difference of this magnitude was not expected.

4. SAMPLING OF MESOPHYTIC FOREST - The mesophytic forest of the Elm Fork region was sampled utilizing the transect method and dbh (diameter breast height) was measured to the nearest centimeter. A typical 100 meter transect yielded the following species frequency and total dbh data: Cedar Elm (22 - 3050), Creeper (10 - 380), Hickory (6 - 190), Greenbrier (5 - about 40), Ash (5 - 825), Hackberry (5 - 1100), Boxelder (4 - 80), Bumelia (4 - 180), Osage Orange (3 - 875), Coralberry (3 - 95). Cedar Elm and Hackberry are prominent in terms of biomass (organic weight) but the most impressive aspect of this forest is its diversity. Only major plants are listed above. Horizontal zonation is pronounced in undisturbed areas. The most mesic zone at bankside includes the following woody plants: Cottonwood (Populus deltoides), Boxelder (Acer negundo), Red Ash (Fraxinus pennsylvanica) and the Willow (Salix sp.); common herbaceous plants along this zone are: Lippia sp. and sedges of the family Cyperaceae. A slightly less mesic zone is developed in scattered sites comprising

Euphorbia bicolor, Fleabane (*Erigeron* sp.), Tumblegrass (*Schedonnardus paniculatus*), Buffalobur (*Solanum rostratum*) and *Croton* sp.

5. MAMMALS - Trapping, utilizing mostly Sherman live traps and a few Museum-Special snap-traps, was accomplished in 5 different ecologic associations: (1) Mesophytic Forest, (2) Old-Field Grasses (eradicated forest and disturbed prairie grasses), (3) Blackland Prairie Grasslands, (4) Bare-soil (bull-dozed forest) and (5) cross-timber forest. Sampling comprised 745 trap-nights. Trapping yielded 49 specimens representing 5 genera. Collections were taken in the flood-plain to the terraces. Trapping distribution is presented below in tabular form.

NUMBER OF TRAP NIGHTS AND CATCHES IN DIFFERENT ENVIRONMENTS

	MESOPHYTIC	BARE SOIL (BULL-DOZED FOREST)	CROSS TIMBERS	OLD-FIELD GRASSES	BLACKLAND PRAIRIE
Trap-Nights	47 21 21 21 15	47 47 (1 Peromyscus near bull-dozed trees)	25 25 (19 Sigmodon 3 Peromyscus 2 Mus 2 Rattus 1 Reithrodontomys) 27 specimens	ERADICATED MESOPHYTIC FOREST 47 38 38 15 (6 Sigmodon 1 Mus) 7 specimens	DISTURBED 50 50 50 (No catch) SLIGHT STRESS 50 (5 Sigmodon 1 Rattus 2 Mus 1 Peromyscus) 9 specimens RELATIVELY UNDISTURBED 50 50 (2 Sigmodon 7 Mus) 9 specimens
TRAP NIGHTS SPECIMENS	125 0	94 1	50 27	176 7	300 18

The cotton rat (Sigmodon) is highly adaptable and occurs in both disturbed as well as relatively undisturbed areas as long as grassy cover is available. The Norway Rat (Rattus) and the House Mouse (Mus) dwell near human habitations. The Harvest Mouse (Reithrolontomys) lives in both grassland and open forest especially savannahs. The Deer Mouse (Peromyscus maniculatus) is chiefly a dense forest inhabitant.

According to Blair (1950) and Burt and Grossenheider (1964) there are about 45 species of mammals in the Elm Fork region. However, many of the original habitats have been decimated or greatly modified by human activity and there are probably less than 40 mammalian species remaining. The signs of Beavers (Castor) are common along the Elm Fork. In addition the Muskrat (Ondatra), Armadillo (Dasypus), Raccoon (Procyon), Opossum (Didelphis), Swant Rabbit (Sylvilagus), Striped Skunk (Mephitis), two species of squirrels (Sciurus) and the Gray Fox (Urocyon) are typical inhabitants of the mesophytic forest.

6. AMPHIBIA - About 12 species of Amphibia are reported from the Elm Fork region (Conant, 1958). Two very interesting tree-frogs live in ponds and swamps adjacent to the Elm Fork, the Green Treefrog (Hyla cinerea) and the Gray Treefrog (Hyla versicolor). All amphibian species are dependent on rather high humidity micro-climates for completion of their life cycle.

7. REPTILES - About 44 species of reptiles are reported from the Elm Fork region (Conant, op. cit.). The Cottonmouth (Agkistrodon

piscivorus), Pigmy Rattlesnake (Sistrurus miliaris), Garter Snake (Thamnophis sirtalis), Diamond-Backed Water Snake (Natrix taxispilota), the Blotched Water Snake (N. erythrogaster), the Broad-Headed Skink (Eumeces laticeps), Five-Lined Skink (E. fasciatus) and the Ground Skink (Lygosoma laterale) are all high humidity water and forest species. The same is true for eight of nine species of turtles which occur in the Elm Fork region.

8. BIRDS - Pulich (1961) reports that about 320 species of birds occur in the study region. Texas leads all other states in varieties of birds, about 500. Some 43% of the Elm Fork avifauna are migratory species which 'stop-over' along the mesophytic forest in particular during spring and fall. Many migratory and resident birds are spectacular: the gaudy Painted-Bunting, Promonothary Warbler, Red-Tail Hawk, Belted Kingfisher and the Great Blue Heron. The giant Pileated Woodpecker was exterminated by man several decades ago.

Discussion

If it were not for inappropriate occupancy and misusage by man of the Elm Fork valley there would be no need for flood-control measures. The Elm Fork tributary like numerous other meandering streams is subject to relatively few instances of moderate flooding. In a matter of hours or at most a few days the flood waters recede leaving rich layers of alluvium.

In any case this study must confine itself to feasible

objectives. An initial point should be emphasized; the alluvial flood plain is a high-nutrient but restricted region but the grassland prairies (Blacklands) of North America are among the most fertile agricultural regions in the world (not withstanding an astonishing statement to the contrary stated in "Trinity River and Tributaries, Texas", Vol. V). Both areas should be conservatively grazed by livestock and held as a potential resource for agriculture until conversion about 2040. The year 2040 or slightly later is emphasized because the best projections indicate that our national population will reach 400 million and this will dictate a change in dietary practices - meats, milk, eggs will be in very short supply because our citizens will have to 'step-down' a rung on the food chain and utilize all available lands for agriculture rather than devoting some areas to range lands. In fact a prestigious group of scientists from 14 countries, utilizing the best systems-analysis specialists and the most versatile M.I.T. computer facilities, have assembled a host of data predicting global economic collapse as early as 2040. I mention global events because study of proposed flood-control on the Elm Fork ought not be compartmentalized. Pollution increments, population increase, over-depletion of resources (energy), erosion of ecosystems and quality of life occur in a multitude of small steps. This is precisely what is happening to the unique mesophytic forest lining the Elm Fork; the forest is under constant small-scale destruction.

This forest is not merely a beautiful area. It is of ecologic

importance beyond its acreage. The estimated 'Turn-Over' time of this forest is about 9 years (lag-time between death of forest parts, their decomposition, and replacement by subsequent living parts). Well over 90% of forest production is channeled through the debris or detritus food chain rather than through large animals. The system is mature and 'finely-tuned' in nutrient cycling, oxygen release and moisture-release. In addition this forest furnishes an ideal set of habitats for macroconsumer detritus animals. Only recently have ecologists realized the enormous importance of these animals in the recycling complex. Such creatures as certain nematodes, spring-tails, annelid worms and crayfish pass detritus through their intestines and release detritus in small particles whose increased surface area lends itself to more complete microbial degredation. Urban dwellers tend to feel detached and divorced from external natural areas but, of course, the balanced ecosystems supply them with food, oxygen and water. The Cross Timers which are reasonably undisturbed and the Prairie grasslands continue to supply efficiently these vital ingredients. Over-grazing of the Blackland prairie area of the Elm Fork has resulted in a species shift; one finds numerous stands of buffalo-grass and curly mesquite grass - indicators of grazing pressure (Gould, 1962).

One cannot help but notice that proposed 'changes' are almost invariably referred to as 'improvements'. Past experience makes it clear that these terms are not synonyms. One of the greatest dangers to our bioshphere is the human tendency to continually reduce

'lag-time'. We do not know precisely how close we are to a lethal reduction but we must make sure that vast acreage be set aside so that animal utilization of plant metabolism does not reach proportions which denies the essential 'lag-time' required for recycling.

The Elm Fork flood valley should be free of permanent human construction. Certainly housing should be permitted no closer to the river than the levee region. Prairie grasses near the confluence of the Elm Fork and the West Fork are regularly mowed. The cuttings accumulate on the ground, become dry and constitute a greater fire hazard than if no mowing was done at all.

The 'Springer Plan' (Spring, 1969) for the Elm Fork in the City of Dallas appears to be substantially sound. This plan endorses publicly owned green-belt zones without disturbance to the river. Plantings however should involve several species of trees randomly placed. Small-leaf trees are preferable because they are more resistant to most air pollutants.

ENVIRONMENTAL IMPACT OF PROPOSED FLOOD CONTROL
PROJECT FOR THE ELM FORK REGION

I. Predicted Environmental Impacts of Proposed Action Summarized From Results of This Study.

1. At least nine of known archaeological sites located on the flood-plain will be affected by the proposed rechannelization.
2. An equal number of sites located on the T-1 terrace will also be damaged or destroyed due to levee construction.
3. Numerous, undiscovered subsurface sites located on the flood-plain and T-1 terrace undoubtedly will be destroyed if the construction plans are implemented.
4. Rechannelization and levee building in the flood-plain and T-1 terraces would be expected to destroy numerous subsurface paleontological sites.
5. If the T-2 terraces are used as a source for levee material, other important vertebrate fossil remains would most likely be destroyed.
6. Decreased stream benthic populations due to habitat alteration and to an actual decrease in bottom area. This may result in a deterioration of water quality.
7. More rapid movement of water downstream from Lewisville Dam to the Dallas water plants resulting in less time for the removal of particularly organic pollution by the river

community.

8. Probable increased turbidity and water temperature resulting from the loss of forest canopy.
9. Probable significant decrease in fish produced due to smaller surface acreage of the system and lower primary and secondary river production.
10. Decreased species diversity in the fish population due primarily to the interruption of the pool-riffle sequence and the creation of more uniform current flow.
11. No endemic or endangered fish species occur in the Elm Fork study area. However, the river's fish fauna is unusually diverse due to the Elm Fork's location in a transition zone between the Blackland Prairie and the Eastern Cross Timbers
12. Probable destruction of most of mesophytic forest which is unique to streamways. This would result in upset of 'fine-tuning' of nutrient cycling rhythms and an irreversible and major loss of the terrestrial nutrient-bank of the area would occur.
13. There are no endemic species in the study area although the mink could be regarded as endangered in the feral state in Texas. However the proposed action would cause elimination of virtually all species which dwell in the mesophytic forest plus the displacement of over 150 species of migratory birds which regularly stop-over in river forest areas twice a year.

14. Probable encouragement of increased human activity in the stream valley with subsequent increased rate of forest destruction, over-grazing, construction of asphalt streets and dwellings and an expansion of the practice of plowing of croplands. Plowing results in decreased fertility of soils of study area because of increased leaching which leads to massive and expensive energy subsidies (fertilizers, herbicides, etc.).

II. Alternatives to Proposed Action.

The best alternative to the proposed plan would be to place the floodplain area in public trust as part of the environmental corridor system as proposed in the North Central Texas Council of Governments (Regional Open Space Plan, 1972). Uses of the floodplain should be restricted to recreational functions consonant with good ecological practices. For example, canoeing, hiking, nature study, fishing would be appropriate uses. It is strongly recommended that the 'Springer Plan' (1969) be extended to the Denton County Line, and northwest from the Denton County Line to Lewisville Dam the floodplain be preserved as an environmental corridor. This environmental corridor should be allowed to return to a natural state. Floodplain as here used is defined as the land that would be inundated by a standard project flood.

The authors of this study feel that this is a particularly

critical area to be utilized in the above-mentioned fashion due to its location in the center of a rapidly expanding urban and industrial area. This particular location would be more accessible for recreational and aesthetic utilization than any other major area in the immediate Dallas region.

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1

Roads

Railroads

Powerlines

Pipelines

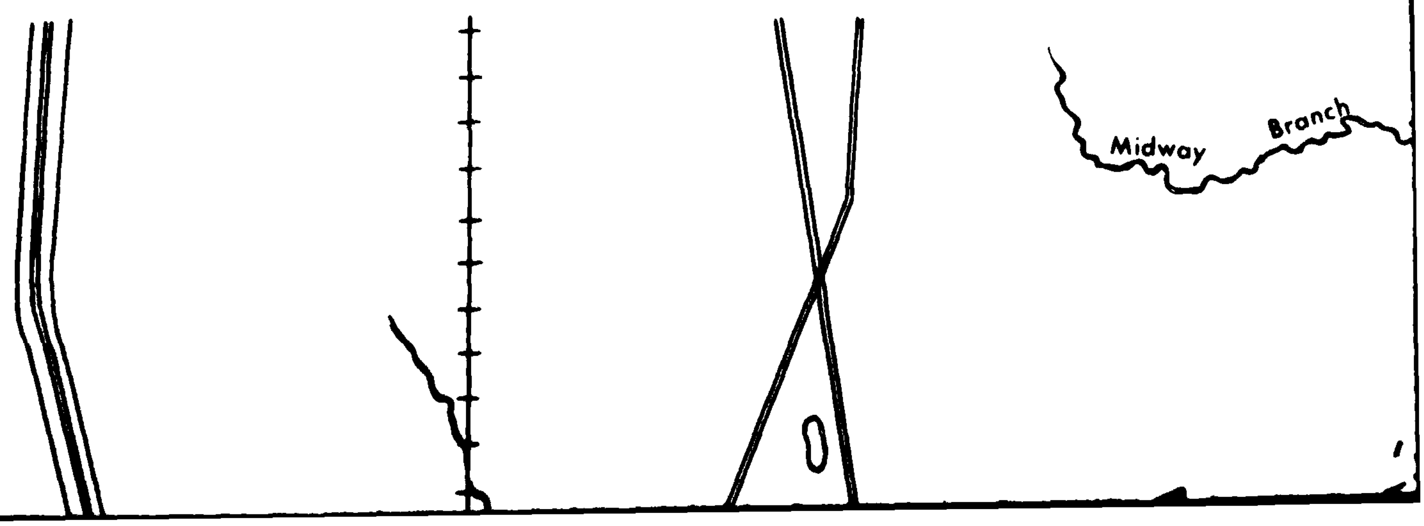
Proposed Channel

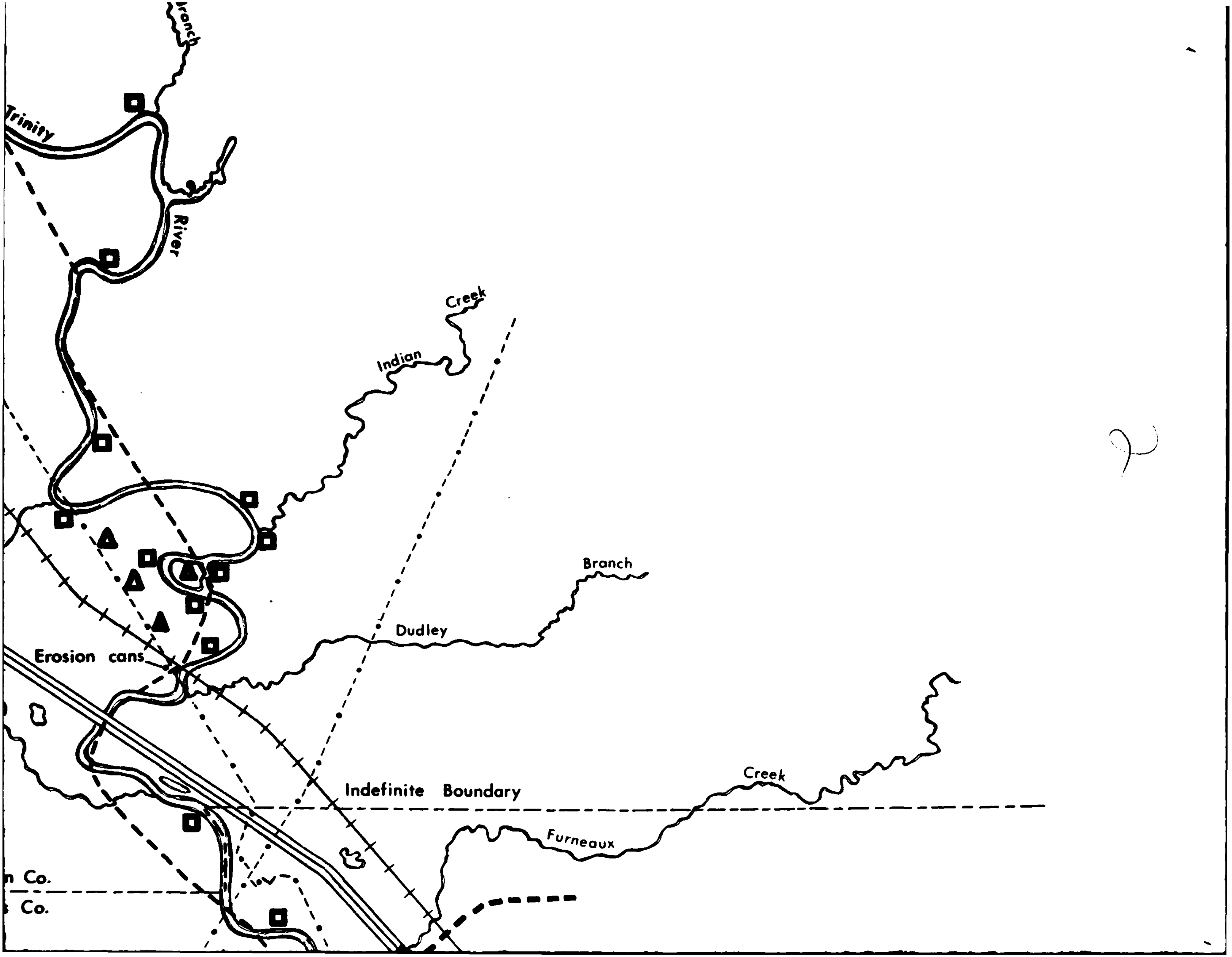
Proposed Levee

Endangered Archaeological Locales

Principle Aquatic Sampling Areas

Principle Terrestrial Sampling Areas





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Erosion cans
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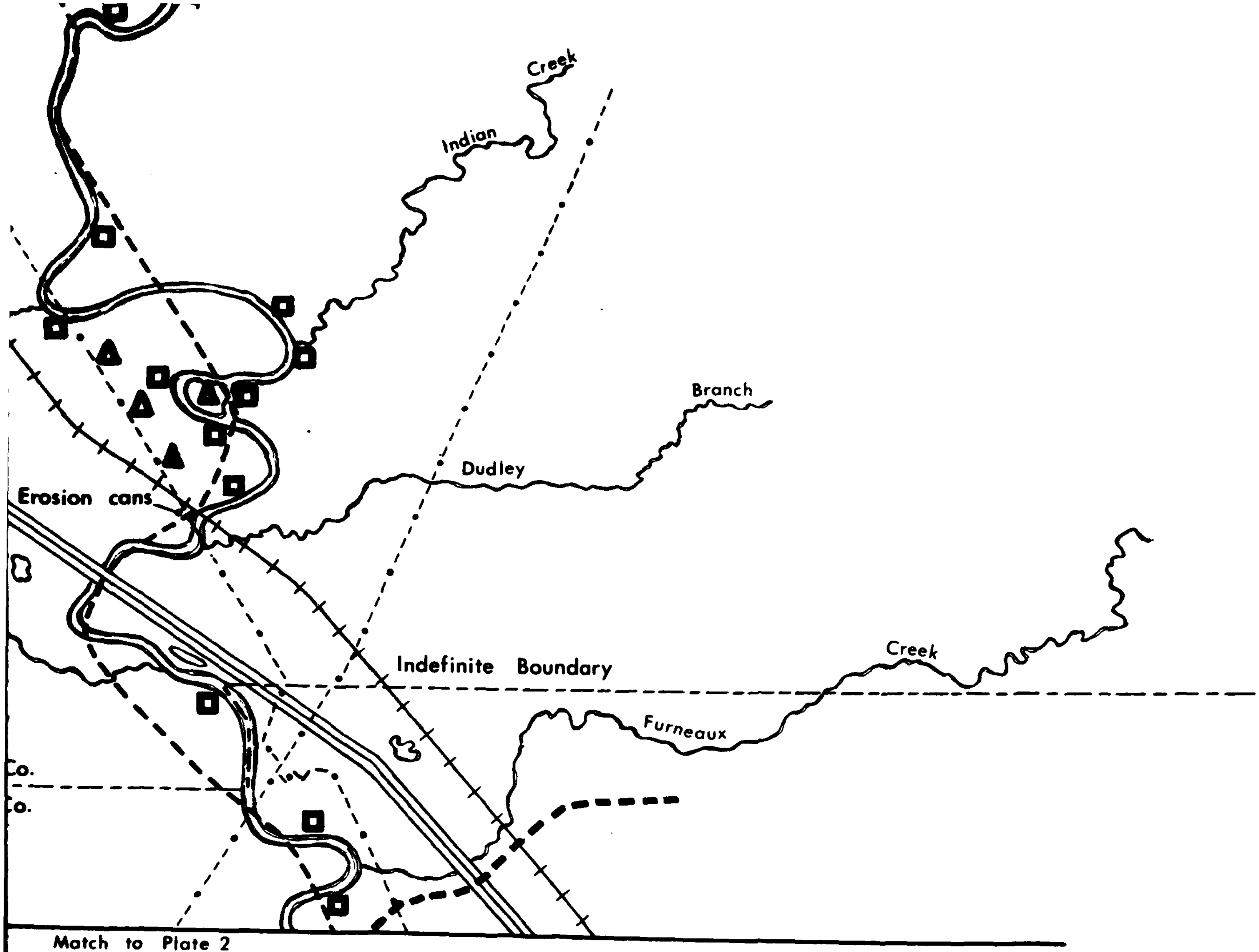
2



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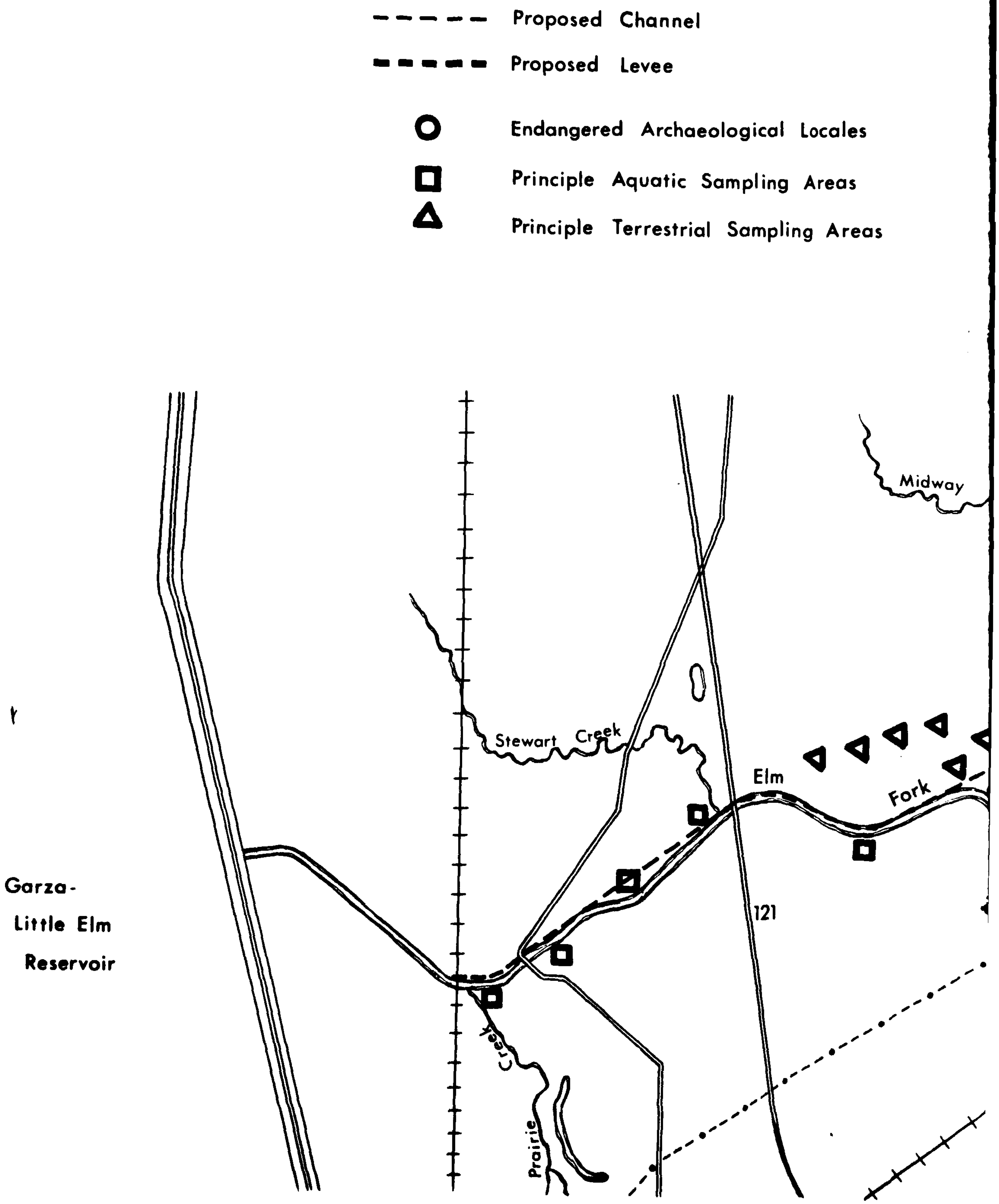
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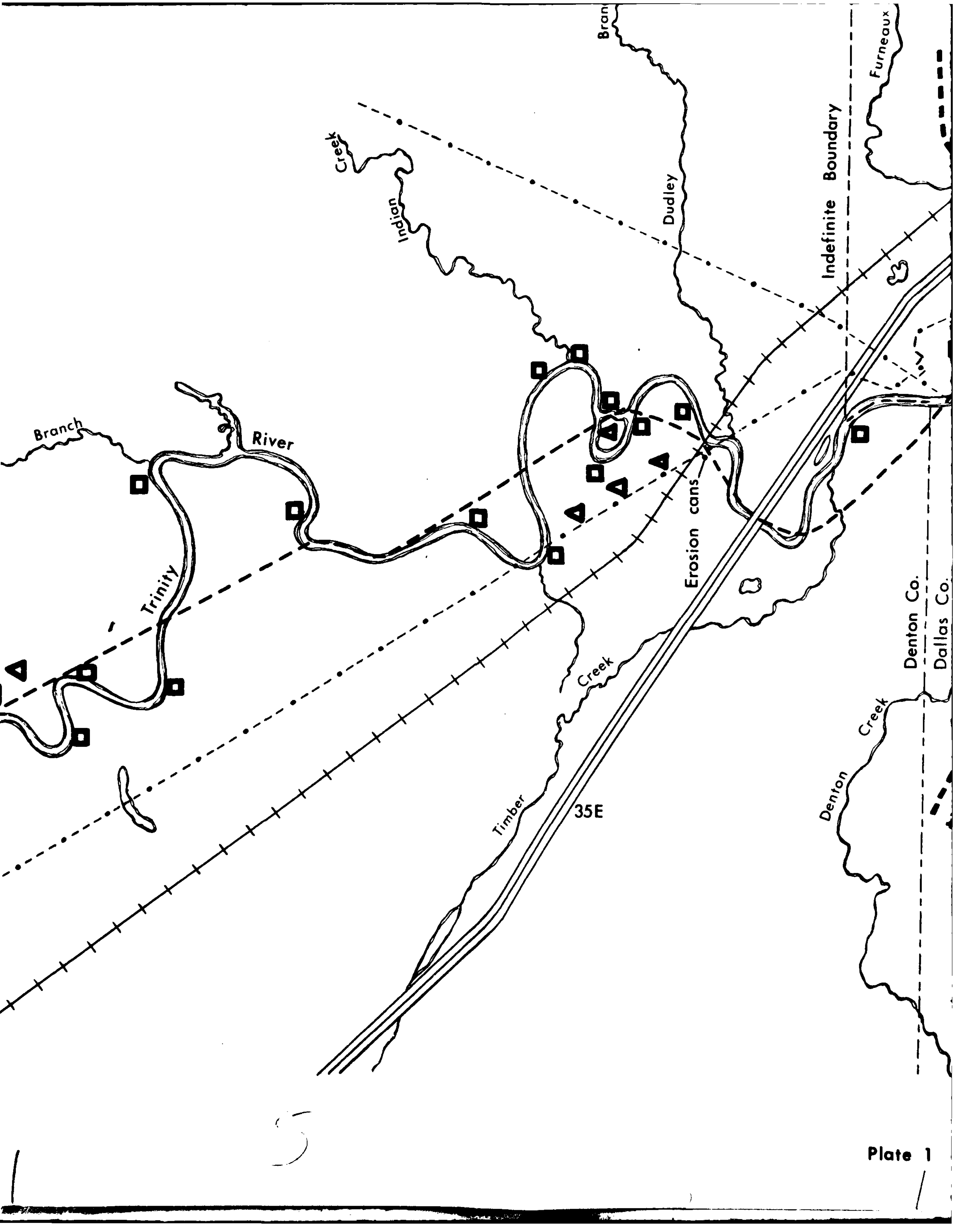
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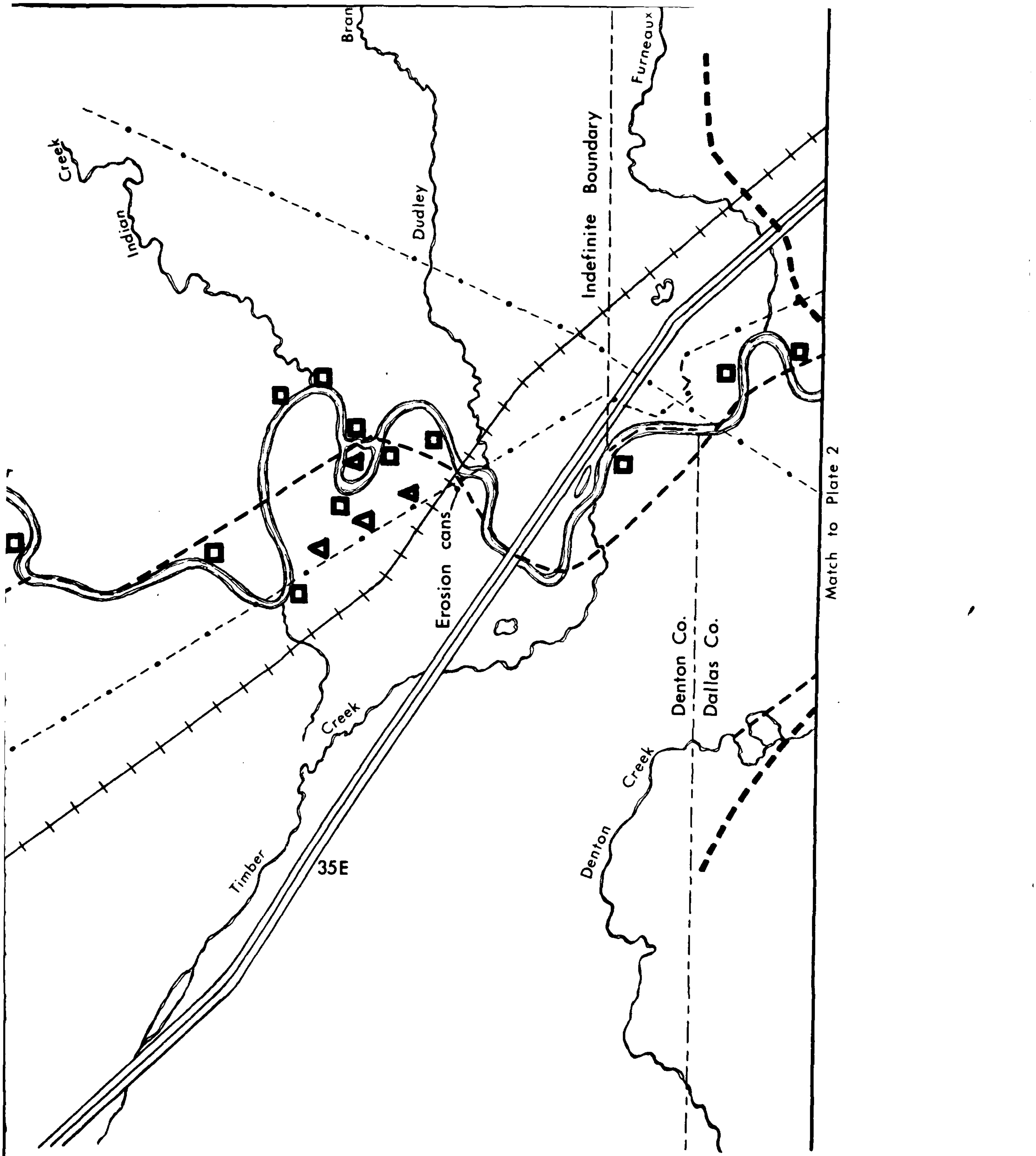
Dallas Co.
Creek
Denton

Plate 1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Denton
Creek

Plate 1

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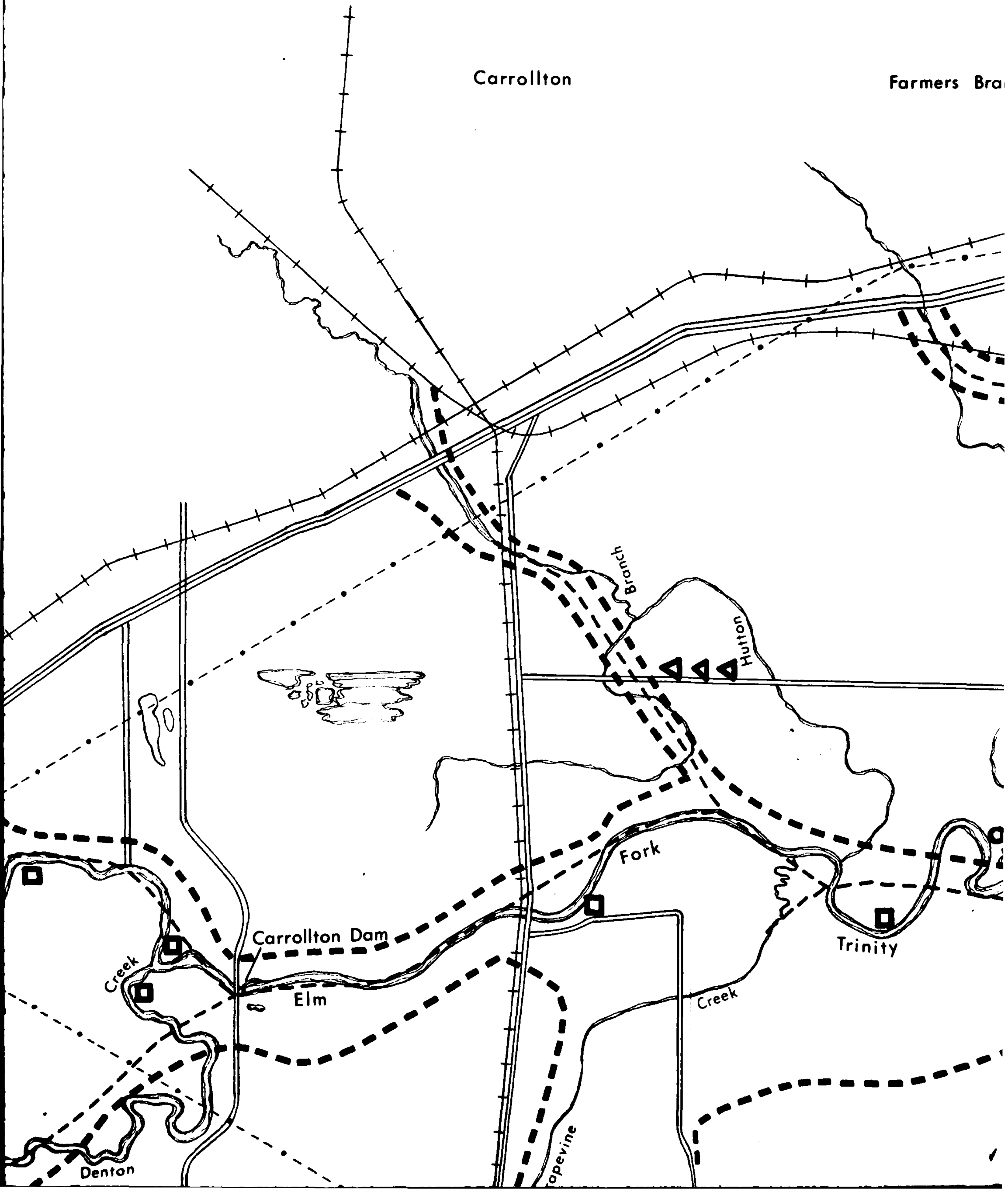
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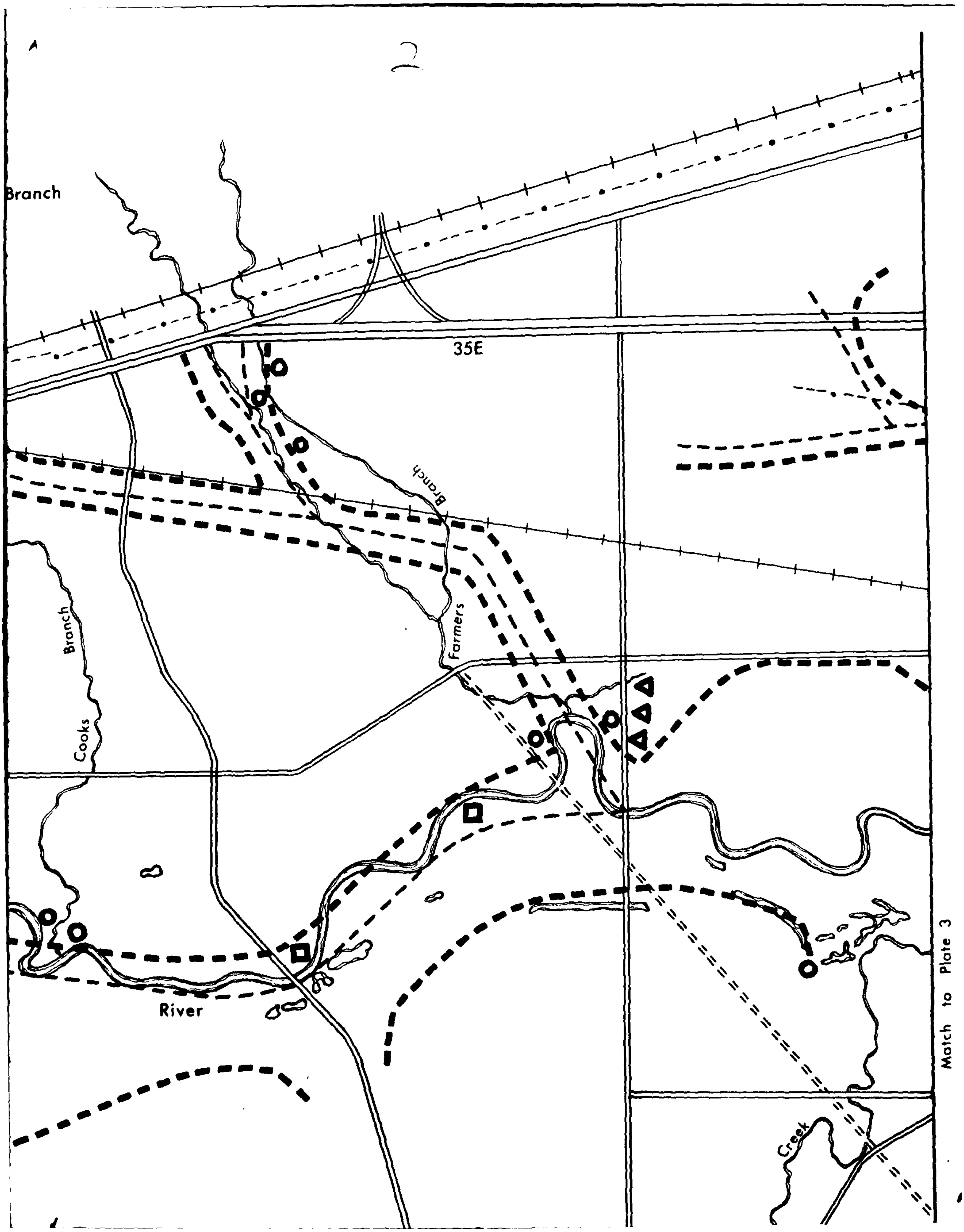
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Cooks
River
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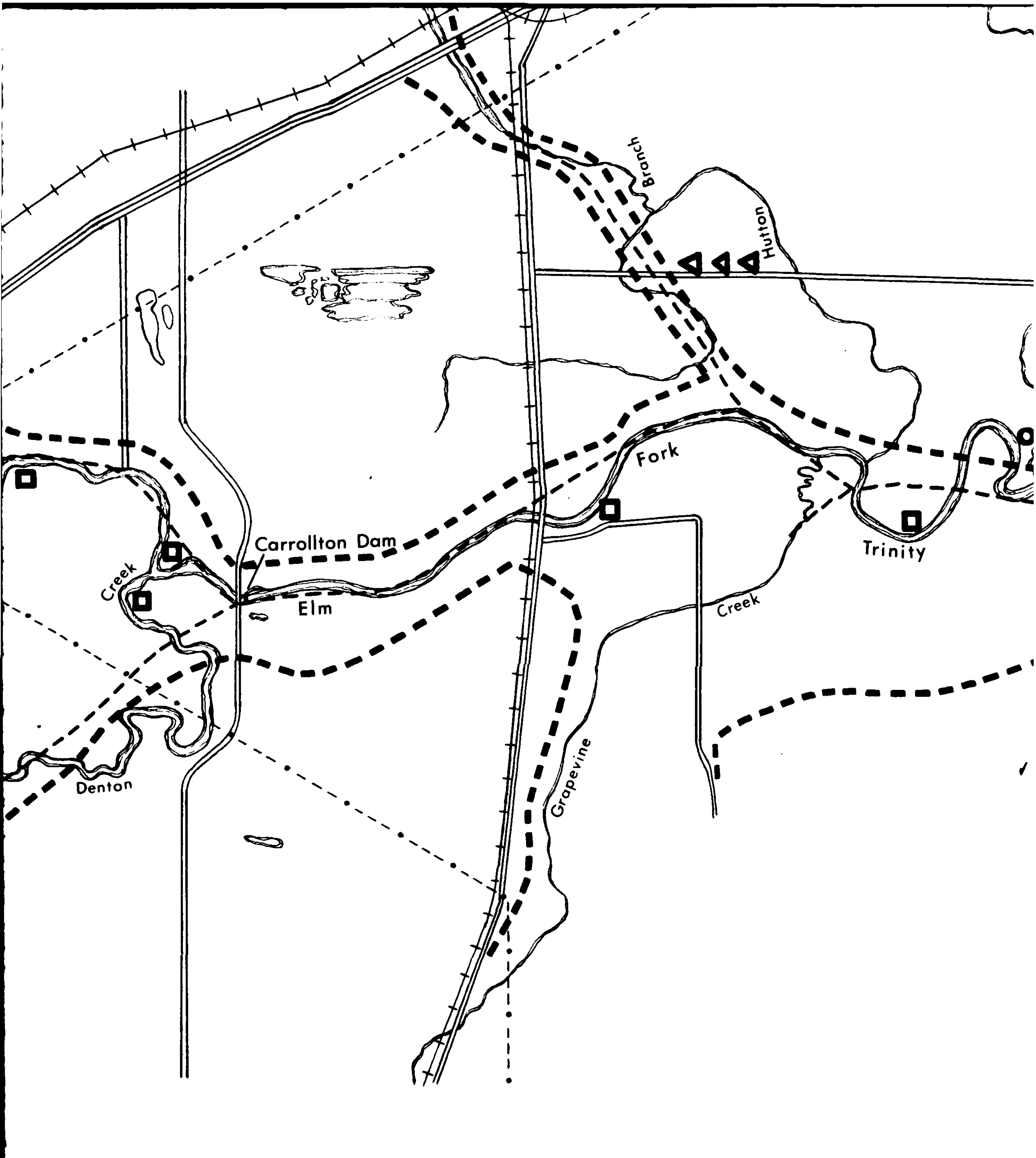
Match to Plate 3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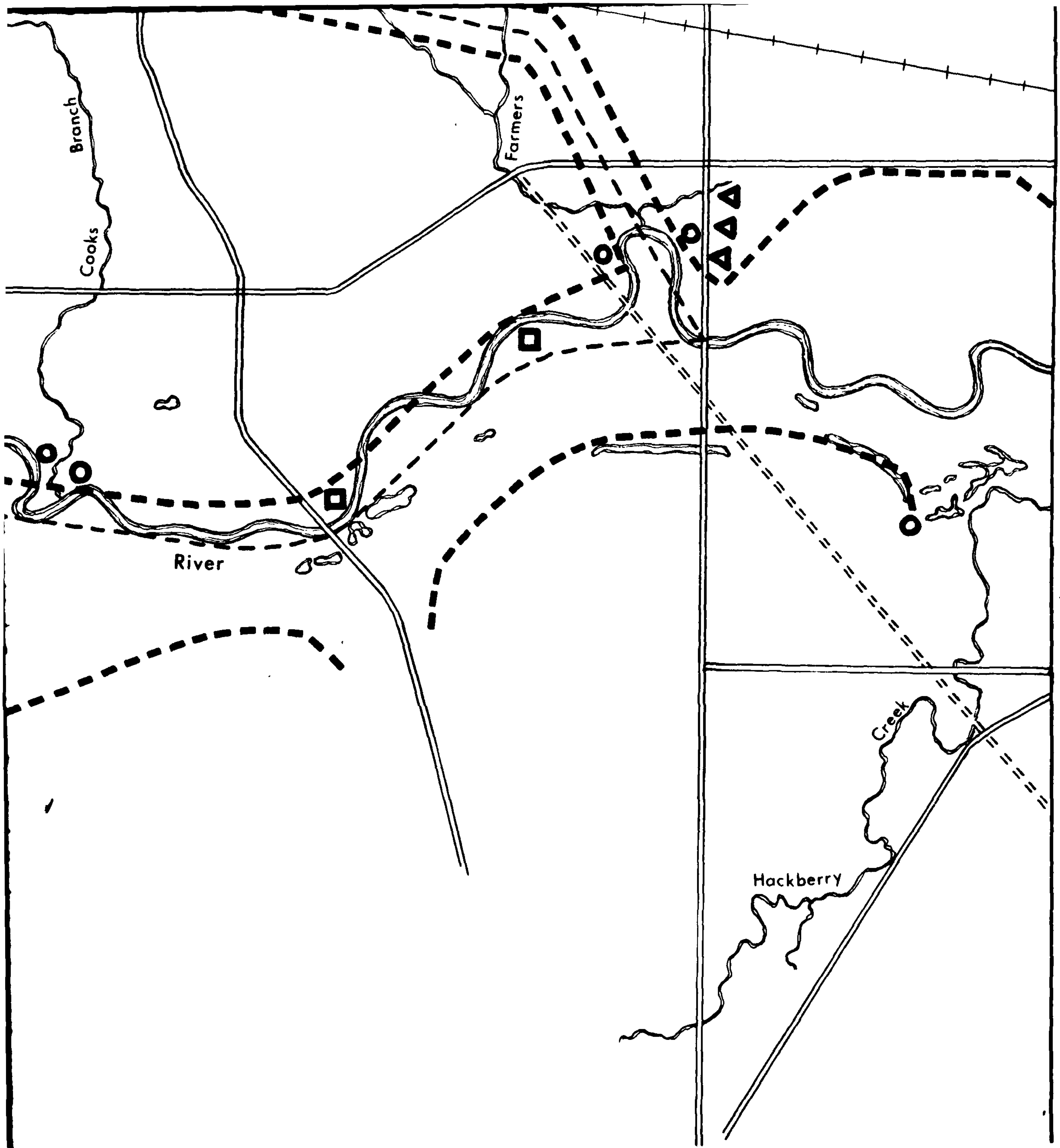
3



Cooks Branch
Farmers
River
Hackberry Creek
Match to Plate 3

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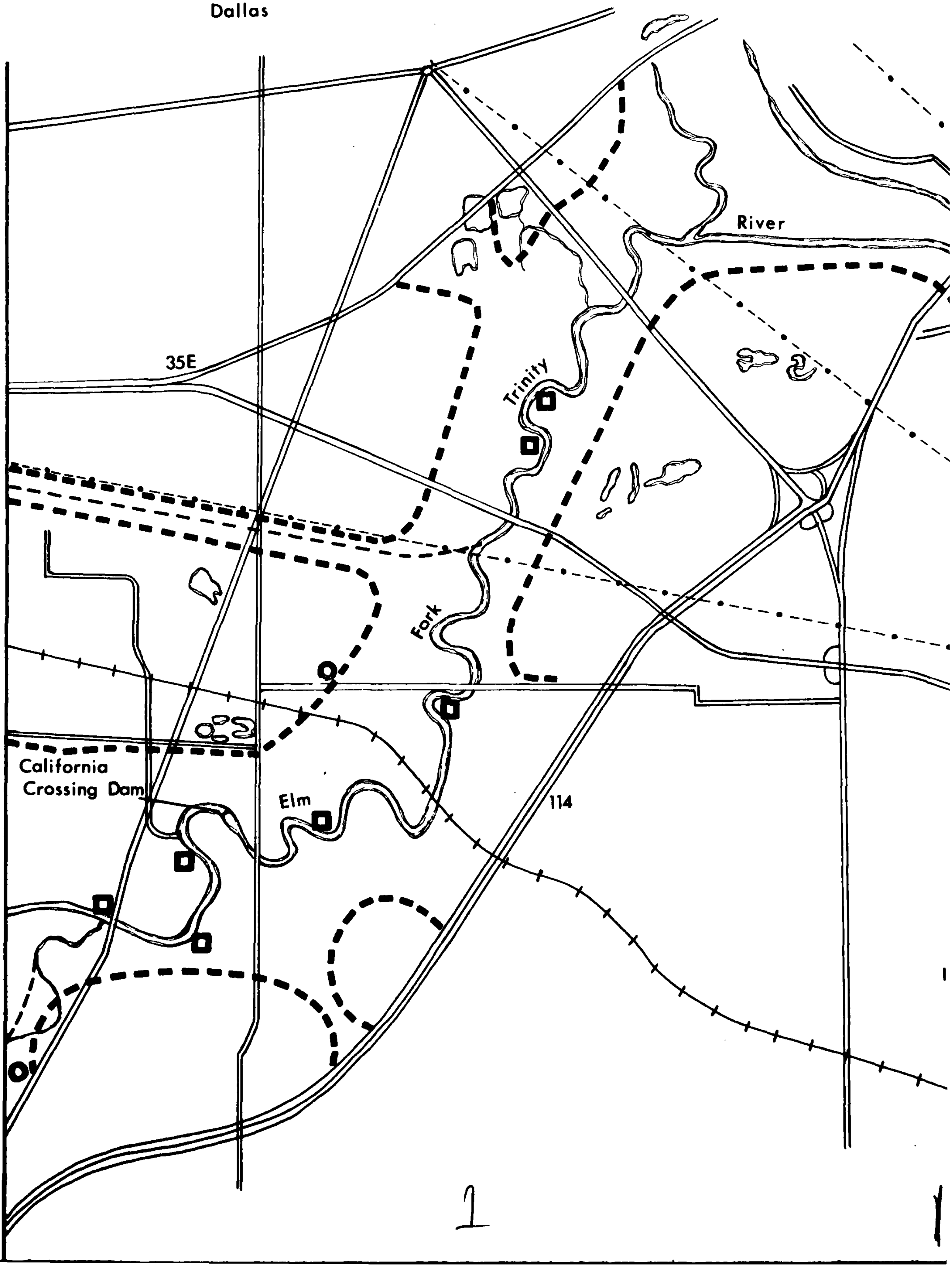
Plate 2


Dallas
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Trinity
Fork
California
Crossing Dam
Elm
114
Match to Plate 2

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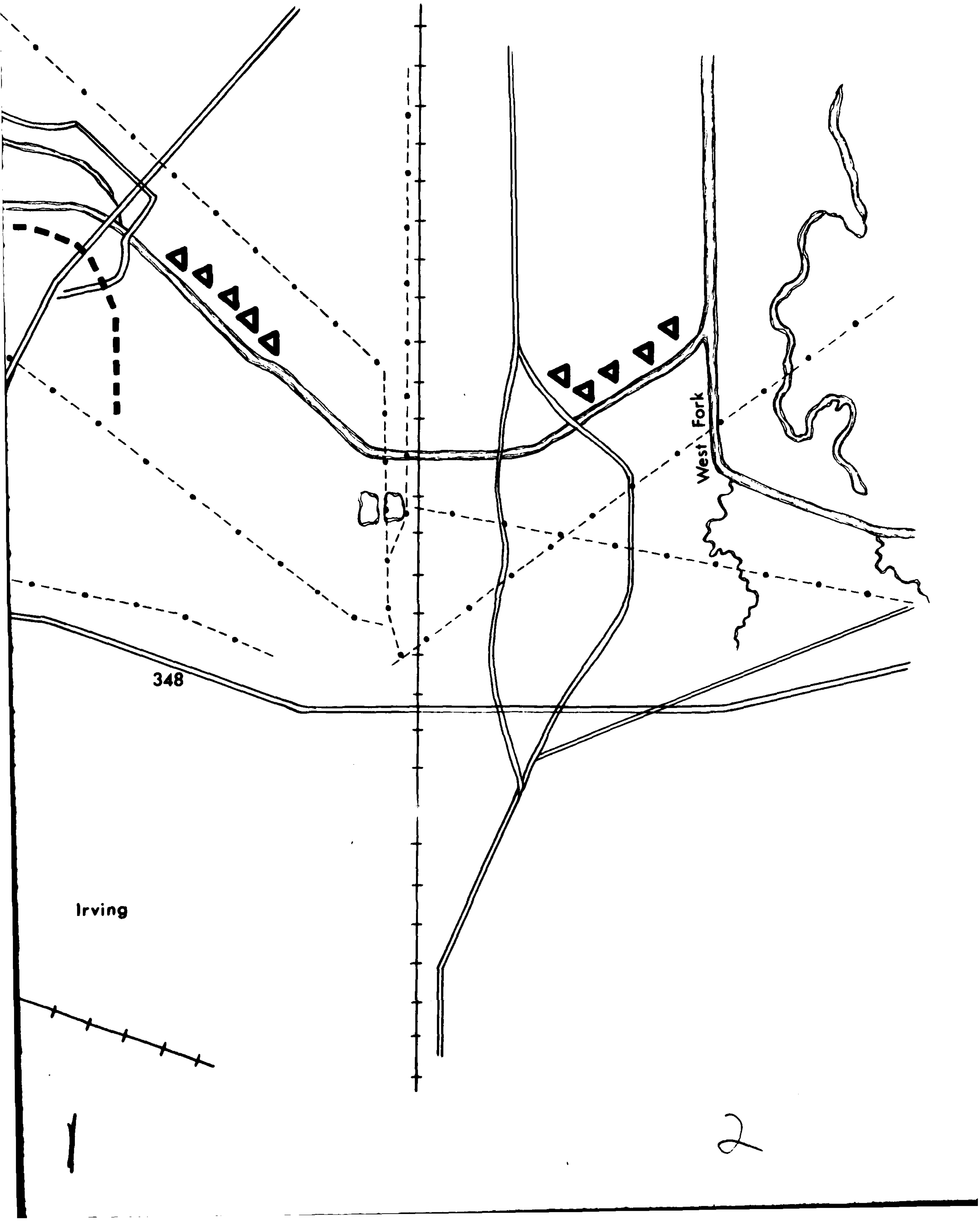

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